212-027-11

1

INSTALLATION RESTORATION PROGRAM
PHASE II - CONFIRMATION/QUANTIFICATION
STAGE I - FINAL REPORT
VOLUME II

BERGSTROM AIR FORCE BASE, TEXAS 78743

Contractor: Radian Corporation
Post Office Box 9948
8501 Mopac Blvd.
Austin, Texas 78766-0948

April 1987

Final Report, March 1984 - August 1986

APPROVED FOR PUBLIC RELEASE:
DISTRIBUTION UNLIMITED

PREPARED FOR:

HEADQUARTERS, TACTICAL AIR COMMAND
COMMAND SURGEON'S OFFICE (HQ TAC/SGPB)
BIOENVIRONMENTAL ENGINEERING DIVISION
LANGLEY AIR FORCE BASE, VIRGINIA 23665

UNITED STATES AIR FORCE
OCCUPATIONAL & ENVIRONMENTAL HEALTH LABORATORY (USAFOEHL)
TECHNICAL SERVICES DIVISION (TS)
BROOKS AIR FORCE BASE, TEXAS 78235-5501

RADIAN
CORPORATION

INSTALLATION RESTORATION PROGRAM
PHASE II - CONFIRMATION/QUANTIFICATION
STAGE 1

FINAL REPORT
VOLUME 2

FOR

BERGSTROM AIR FORCE BASE, TEXAS 78235

HEADQUARTERS, TACTICAL AIR COMMAND
LANGLEY AIR FORCE BASE, VIRGINIA 23665

APRIL 1987

PREPARED BY:

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USAF CONTRACT NO. F33615-83-D-4001, DELIVERY ORDER NO. 11
RADIAN CONTRACT NO. 212-027-11

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This report has been prepared for the United States Air Force by Radian Corporation, Austin, Texas, for the purpose of aiding in the implementation of the Air Force Installation Restoration Program. It is not an endorsement of any product. The views expressed herein are those of the contractor and do not necessarily reflect the official views of the publishing agency, the United States Air Force, nor the Department of Defense.

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APPENDIX A

ABBREVIATIONS USED IN THIS REPORT

APPENDIX A

Definitions, Nomenclature, and Units

- AFB - Air Force Base
- AGL - Above Ground Level
- ^ - Approximate (symbol)
- APX - Approximate (abbreviation)
- Aquifer - Geologic Unit Capable of Storing and Transmitting Significant Quantities of Water
- B - Boring
- BG - Background
- BGL - Below Ground Level
- BLS - Below Land Surface
- CH - Corehole
- DOD - Department of Defense
- EMP - Electromagnetic Profiling
- EPA - Environmental Protection Agency
- G - Grab Sample
- GC - Gas Chromatography
- GC-MS - Gas Chromatography/Mass Spectrometry
- IRP - Installation Restoration Program
- mg/L - Milligrams Per Liter
- MSL - Mean Sea Level
- MW - Monitor Well
- N/A - Not Applicable
- NR - No Reading
- O&G - Oil and Grease
- PPM - Parts Per Million
- PVC - Polyvinyl Chloride
- RCRA - Resource Conservation and Recovery Act
- SS - Split Spoon Sample
- ST - Shelby Tube Sample
- SW - Surface Water

- SWL - Static Water Level
- TOC - Total Organic Carbon
- TOX - Total Organic Halogens
- ug/L - Micrograms Per Liter
- ug/ml - Micrograms Per Milliliter
- USAF - United States Air Force
- VOC - Volatile Organic Compound

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APPENDIX B

SCOPE OF WORK

Revision #1 Dated 84 Aug 27

84 JUN 26

INSTALLATION RESTORATION PROGRAM*
Phase II Field Evaluation
Bergstrom AFB TX

I. Description of Work

The purpose of this task is to determine if environmental contamination has resulted from waste disposal practices, fuel spills and fire training activities at Bergstrom AFB TX; to provide estimates of the magnitude and extent of contamination, should contamination be found; to identify potential environmental consequences of migrating pollutants; to identify any additional investigations and their attendant costs necessary to properly evaluate the magnitude, extent, and direction of movement of discovered contaminants.

Ambient air monitoring of hazardous and/or toxic material for the protection of contractor and Air Force personnel shall be accomplished when necessary, especially during the drilling operation.

The presurvey report (mailed under separate cover) and Phase I IRP report (mailed under separate cover) incorporated background and description of the sites for this task. To accomplish the survey effort, the contractor shall take the following steps:

A. General

1. Determine the aerial extent of each site by reviewing available aerial photos of the base, both historical and the most recent panchromatic and infrared, and by field reconnaissance.

2. Locations where surface water, sediment, and core samples are collected shall be marked with a permanent marker, and the location recorded on a site map.

3. A total of six monitoring wells shall be installed. The exact location of the wells shall be determined in the field.

4. Ground-water monitoring wells shall be completed to a depth of at least 10 feet below the average water table surface. All wells shall be developed, water levels measured, and locations surveyed and recorded on a site map.

5. Ground-water monitoring wells shall comply with U.S. EPA publication 330/9-81-002 <u>NEIC Manual for Groundwater/Subsurface Investigations at Hazardous Waste Sites</u>, and State of Texas requirements for monitoring well installation. Only screw type joints shall be used. Glue fittings are not permitted.

*Highlights of modification are underscored

6. All water samples shall be analyzed on site by the contractor for pH, temperature, and specific conductance. Sampling, maximum holding time, and preservation of samples shall comply strictly with the following references: Standard Methods for the Examination of Water and Wastewater, 15th Ed. (1980), pp 35-42; ASTM, Part 31, pp 72-82, (1976), Method D-3370; and Methods for Chemical Analysis of Waters and Wastes, EPA Manual 600/4-79-020, pp xiii to xix (1979). All water samples shall be analyzed using minimum detection levels, as specified in Attachment 1.

7. Field data collected for each site shall be plotted and mapped. The nature of contamination and the magnitude and potential for contaminant flow within each site to receiving streams and ground waters shall be determined or estimated. Upon completion of the sampling and analysis, the data shall be tabulated in the next R&D Status report, as specified in Item VI below.

B. In addition to items delineated in A above, conduct the following specific actions at sites identified on Bergstrom AFB TX:

1. Monitoring of Existing Wells

a. The contractor shall collect and analyze one ground-water sample from the existing well at the Golf Course. If the well cannot be sampled due to well development, well characteristics, or any other reason, the contractor shall indicate the reason(s) in the report specified in Item VI below.

b. The ground-water sample shall be analyzed for oil and grease-infrared method (O&G/IR), Total Organic Carbons (TOC), Total Organic Halogens (TOX), phenols, arsenic, barium, lead, chromium, cadium, silver, mercury, selenium, and the organochlorine pesticides (including DDT isomers) specified in U.S. EPA method 608, and 2,4-D, 2,4,5-TP silvex, and dibrom (as specified in Attachment 1).

c. The ground-water sample analyzed for organochlorine pesticides (including DDT isomers) specified in U.S. EPA method 608 shall be confirmed by the second gas chromatographic column which can be used to confirm measurements made with the primary column.

2. Site 17. South Fork Drainage Ditch

a. Collect 13 sediment samples from the site, one sample at the farthest upstream point of the ditch, one sample upstream of the oil/water separator, one sample downstream of the oil/water separator, one sample upstream of the landfill area, and nine samples in the landfill area.

b. Each sediment sample shall be analyzed for oil and grease-infrared method (O&G/IR), and lead, nickel, chromium, and copper.

3. Site 13. MOGAS Spill at Motor Pool

a. One soil boring shall be drilled at this site to a depth of 5 feet below the average water table surface. Samples shall be retained for analysis at 2 1/2-foot intervals from the surface to 20 feet BLS. From 20-45 feet BLS, samples shall be retained for analysis at five foot intervals and at the saturated/unsaturated zone interface. A maximum of six samples shall be analyzed.

b. Each soil sample shall be analyzed for O&G/IR, and lead, nickel, chromium, and cadmium.

c. Collect one ground-water sample from the site.

d. The ground-water sample shall be analyzed for purgeable hydrocarbons using U.S. EPA method 602, O&G/IR, Total Organic Carbon (TOC), and lead, nickel, chromium, and cadmium.

e. The groundwater sample analyzed for purgeable hydrocarbons using U.S. EPA method 602 shall be confirmed by the second gas chromatographic column which can be used to confirm measurements made with the primary column.

4. Site 23. Fire Training Area

a. Two soil borings shall be drilled at this site. Borings shall be advanced to 5 feet below the average water table surface. Samples shall be retained for analysis at 2 1/2-foot intervals from the surface to 20 feet BLS. From 20-45 feet BLS, samples shall be retained for analysis at five foot intervals and at the saturated/unsaturated zone interface. A maximum of 12 samples shall be analyzed.

b. Each soil sample shall be analyzed for O&G/IR, and lead, nickel, chromium, and cadium.

c. Collect two ground-water samples from the site.

d. Each ground-water sample shall be analyzed for O&G/IR, TOC, lead, nickel, chromium, and cadmium, and volatile organic priority pollutants using U.S. EPA methods 601 and 602 (VOC).

e. Each ground-water sample analyzed for volatile organic priority pollutants using U.S. EPA methods 601 and 602 (VOC) shall be confirmed by the second gas chromatographic column which can be used to confirm measurements made with the primary column.

5. Sites 3,4,5,6,7 and 14. Combined Southeast Landfill

a. Install six ground-water monitoring wells, one well placed between each of the five landfills and the installation boundary, and one well placed northwest of the landfill area. Wells shall be an average of 50 feet in depth; total footage drilled shall not exceed 300 feet.

b. Collect two water samples from each well.

c. Each ground-water sample shall be analyzed for TOC, O&G/IR, Total Organic Halogens (TOX), phenols, arsenic, barium, cadmium, chromium, lead, mercury, selenium, silver, the organochlorine pesticides (including DDT isomers) and PCBs specified in U.S. EPA method 608, and 2,4-D, 2,4,5-TP silvex and dibrom (as specified in Attachment 1).

d. Each ground-water sample analyzed for the organochlorine pesticides (including DDT isomers) and PCBs specified in U.S. EPA method 608 shall be confirmed by the second gas chromatographic column which can be used to confirm measurements made with the primary column.

e. Collect three soil samples from Site 14 along the road oiling area.

f. Each soil sample shall be analyzed for PCBs using U.S. EPA method 8080.

6. Site 8. JP-4 Spill/Overtopped Tank Area

a. One soil boring shall be drilled at this site to a depth of 5 feet below the average water table surface. Samples shall be retained for analysis at 2 1/2-foot intervals from the surface to 20 feet BLS. From 20-45 feet BLS, samples shall be retained for analysis at five foot intervals and at the saturated/unsaturated zone interface. A maximum of six samples shall be analyzed.

b. Each soil sample shall be analyzed for O&G/IR.

c. Collect one ground water sample from the site.

d. The water sample shall be analyzed for purgeable hydrocarbons using U.S. EPA method 602, O&G/IR, TOC, and lead, nickel, chromium, and cadmium.

e. The ground-water sample analyzed for purgeable hydrocarbons using U.S. EPA method 602 shall be confirmed by the second gas chromatographic column which can be used to confirm measurements made with the primary column.

7. <u>Site 9. JP-4 Suspected Underground Line Leak.</u>

a. <u>Conduct a data review of the results of line pressure testing conducted on utility vaults and lines in the vicinity of Bldg 4544, Bergstrom flight tower, by base liquid fuels personnel on 3 April 1984. In addition, examine fueling and extraction procedures at the JP-4 low-flow point.</u>

b. <u>Conduct an acoustic emissions test of the pipeline. The pipeline shall be accessed by six 3' (W) x 7' (L) ditches excavated by means of a backhoe.</u>

c. If it is determined through the data review and acoustic emissions testing that there is no evidence of any leaks in the JP-4 pipline, all field efforts shall cease and no further work shall be accomplished. The contractor shall file the corresponding R&D Status Report and await further instruction from the USAF OEHL technical monitor.

d. Four soil borings shall be drilled at this site to a depth of 5 feet below the water table surface. Each boring shall be 30 feet in depth. Samples shall be retained for analysis at 2 1/2-foot intervals from the surface to 10 feet below the surface (BLS). From 10-30 feet BLS, samples shall be retained for analysis at five foot intervals and at the saturated/unsaturated zone interface. A maximum of 36 samples shall be analyzed.

e. Each soil sample shall be analyzed for purgeable hydrocarbons using U.S. EPA Method 602. Confirmatory (second column) analysis of soil samples shall be included.

f. Emplace a temporary well casing at each corehole.

g. Collect one ground-water sample from each corehole.

h. Each ground-water sample shall be analyzed for purgeable hydrocarbons using U.S. EPA Method 602. Confirmatory (second column) analysis of water samples shall be included.

i. Conduct a hydrocarbon survey at the four nearby utility manholes. Samples shall be obtained from underground utility vault or lines and collected with evacuated canisters.

j. Collect one air sample from each manhole.

k. Each air sample shall be analyzed for ambient hydrocarbons.

l. Install three ground-water monitoring wells, one well placed upgradient and two placed downgradient of the site. Wells shall be an average of 30 feet in depth; total footage drilled shall not exceed 100 feet.

m. Collect one water sample from each well.

n. Each ground-water sample shall be analyzed for purgeable hydrocarbons using U.S. EPA Method 602. Confirmatory (second column) analysis of the water samples shall be included.

C. Well Installation and Clean-up

The well and boring area shall be cleaned following the completion of each well and boring. Drill cuttings shall be removed and the general area clean. If hazardous waste is generated in the process of well installation the contractor shall be responsible for proper containerization for eventual government disposal. Disposal of drill cuttings are not the responsibility of the contractor.

D. Results of all sampling and analysis shall be tabulated and incorporated in the Informal Technical Information report (Sequence 3 Atch 1 and Sequence 2 Atch 3 as specified in Item VI below) and forwarded to USAF OEHL/CVT for review.

E. Reporting

1. A draft report delineating all findings of this field investigation shall be prepared and forwarded to the USAF OEHL, as specified in Item VI below, for Air Force review and comment. This report shall include a discussion of the regional hydrogeology, well logs of all project wells, data from water level surveys, water quality analysis results, available geohydrologic cross sections, ground-water surface and gradient vector maps, any available vertical and horizontal flow vectors, and laboratory quality assurance information. The report shall follow the USAF OEHL format (mailed under separate cover).

2. Estimates shall be made of the magnitude and direction of movement of contaminants discovered. Potential environmental consequences of discovered contamination shall be identified or estimated. Where survey data are insufficient to properly determine or estimate the magnitude and direction of movement of discovered contaminants, fully justified specific recommendations shall be made for additional efforts required to properly evaluate contamination migration.

3. Specific requirements, if any, for additional soil borings or for future ground-water monitoring must be identified.

F. Cost Estimates

The contractor shall provide cost estimates for all additional work recommended to permit proper determination of contaminants. The recommendations provided shall include all efforts required to determine the magnitude and direction of movement of discovered contaminants along with an estimate of the time required to accomplish the proposed effort. This information shall be provided in a separately bound appendix to the draft final report.

II. Site Location and Dates:

Bergstrom AFB TX
Building, Time and
Dates to be established

III. Base Support: None

IV. Government Furnished Property: None

V. Government Points of Contact:

1. 1Lt Maria R. LaMagna
USAF OEHL/ECQ
Brooks AFB TX 78235
(512) 536-3667
AV 240-3367

2. 2Lt Victoria Reimer
USAF Hospital/SGPB
Bergstrom AFB TX 78743
(512) 479-2204
AV 685-2204

3. Col Jerry P. Dougherty
HQ TAC/SGPAE
Langley AFB VA 23665
(804) 764-5035
AV 432-2180

VI. In addition to sequence numbers 1, 5 and 11 which are applicable to all orders, the reference numbers below are applicable to this order. Also shown are data applicable to this order:

Sequence No.	Block 10	Block 11	Block 12	Block 13	Block 14
Atch 1					
4	ONE/R	84JUL27	84NOV15	85MAR15	*
3	ONE/T	**	**		2
Atch 3					
2	ONE/T	**	**		2

*A minimum of two draft reports will be required. After incorporating Air Force comments concerning the first draft report, the contractor shall supply the USAF OEHL with a second draft report. The report will be forwarded to the applicable regulatory agencies for their comments. The contractor shall supply the USAF OEHL with 20 copies of each draft report and 50 copies plus the original camera ready copy of the final report.

**Upon completion of analysis

VII. The ceiling price Items 0001 and 0002, as contemplated by the payments clause is $88,242.04.

Attachment 1

Levels of Detection are for water unless shown otherwise:

Levels of Detection Required

	VOC	*
**	TOC	1 mg/L
**	TOX	5 µg/L (waters); 5 µg/g (soil)
	Oil & Grease (IR)	0.1 mg/L (waters); 100 µg/g (soil)
	Polychlorinated Biphenyls	0.25 µg/L (waters); 1 µg/g (soil)
	Phenols	1 µg/L (waters); 1 µg/g (soil)
	Arsenic	10 µg/L
	Barium	200 µg/L
	Cadmium	10 µg/L
	Chromium	50 µg/L (waters); 5 µg/g (soil)
	Copper	50 µg/L
	Lead	20 µg/L (waters); 2 µg/g (soil)
	Mercury	1 µg/L
	Nickel	100 µg/L
	Selenium	10 µg/L
	Silver	10 µg/L

Pesticide Analyses (µg/L)

DDT isomer	0.02
Dibrom	0.03
2,4-D	0.06
2,4,5-TP silvex	0.06

For soils, use detection levels shown above, but report values as micrograms pesticide per gram of soil.

* As specified in U.S. EPA Methods 601 and 602.

** Detection levels for TOC and TOX must be 3 times the noise level of the instrument. Laboratory distilled water must show no response. If so, corrections of positive results must be made.

APPENDIX C

WELL-NUMBERING SYSTEM

APPENDIX C

Well-Numbering System

The well and borings drilled at Bergstrom ABF during the Phase II (Stage I) investigation are identified by an alpha-numeric label. Monitoring wells are labeled with the leters MW followed by a dash and then an Arabic numeral (e.g., MW-9). The core holes are labeled with the letter CH followed by a dash and then an Arabic numeral (e.g., CH-3).

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APPENDIX D

WELL LOGS

Field Boring Log

Client	Job Number	Boring Number
RADIAN CORPORATION	84-833	AW-1

Project/Location	Sheet
Bergstrom AFB / Austin, TX	Sheet 1 of 2

Surface Elevation	Groundwater Depth / Date	Total Depth Drilled	Date Drilled
	33.65 TOC / 4/3/84 1050 hrs	40.4'	3/21/84

Drilling and Sampling Methods	
Hollow stem, Free flight Augers	Logged By: Robert L. Sherrill
SS - Split Spoon ST - Shelby Tube	Contractor/Crew: Radian / JSL
Comments: See B[illegible]k of this Page for Monitor Well Details	Drilling Rig Model: Mobil B-53

Sample Number	Depth (Feet)	Sample Type	Sample Disposition: Length	Sample Disposition: Container (J/B/D)	Sample Disposition: Number	Blows and/or Recovery	Symbol	Sample Description
1	0-1.5'	SS	1.5'	B	A047	0-1.5	CH	CLAY highly plastic, no sand, very stiff pp = 3.75 kg/cm², highly organic, dark brown, moist
2	5.0-6.0	SS	1.0	B	A048	5.0-6.0	CH	CLAY similar to above except hard pp >4.0 kg/cm² brown, minor caliche nodules
3	10.0-11.2	ST	1.2	B	A049	10.0-11.2	CL	SANDY CLAY low plasticity, 30% very fine sand, hard pp = 4.25 kg/cm², damp, brown, no odor
4	15.0-16.2	ST	1.2	B	A050	15.0-16.2	SC	CLAYEY SAND poorly graded, 85% very fine sand, 15% clay, compact, brown, damp, no odor
						17-18'	GP	GRAVEL large cobbles, loose
						18-19.5	SC	CLAYEY SAND similar to above
5	20-21.5	ST	1.5	B	A051	20-21.5	GP	SANDY GRAVEL poorly graded, 60% medium angular gravel, 40% medium subrounded sand, saturated, brown
								Top of Saturated Zone is 19.5' bsl

Underground Resource Management, Inc.
Austin, Texas

Field Boring Log

Client	Job Number	Boring Number
RADIAN CORPORATION	84-833	MW-1
Project/Location: Bergstrom AFB / Austin, TX		Sheet 2 of 2
Surface Elevation / Groundwater Depth / Date	Total Depth Drilled	Date Drilled: 3/21/84
Drilling and Sampling Methods		Logged By: Robert L. Sherrill
		Contractor/Crew: Radian / JSL
Comments		Drilling Rig Model: Mobil B-53

Sample Number	Depth (Feet)	Sample Type	Sample Disposition: Length	Container (J/B/D)	Number	Blows and/or Recovery	Symbol	Sample Description
6	25.0-26.5	SS	1.5	B	A052	11/6 10/6 14/6	GP	GRAVEL poorly graded, uniform small
						N=24		gravel, subangular, loose, brown,
								saturated, no odor
								Sediment Change at 29.5' bgl
7	30-31.5	SS	1.5	B	A053	6/6 11/6 16/6	CH	CLAY highly plastic, stiff, moist,
						N=27		green, no odor
8	35.0-36.1	ST	1.1	B	A054	35.0-36.1	CH	CLAY similar to above except dry
9	40.0-40.4	ST	0.4	B	A055	40.0-40.4	CH	CLAY similar to above

Underground Resource Management, Inc.
Austin, Texas

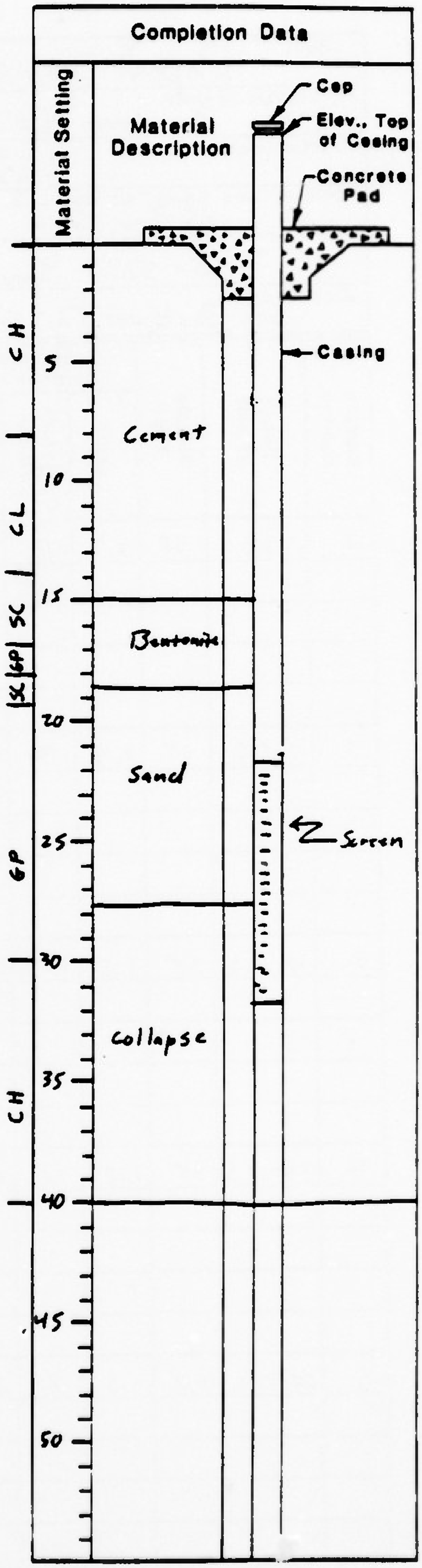
MONITOR WELL #1

Screen is 10' Wire Wrapped Stainless Steel by Smith Screen. Screen is 4" ID.

Pipe is 4" ID Sch 40 PVC with flush joints.

Joint #	Setting (bgl)	Type
1	21.4 - 31.4	Stainless Steel Screen
2	6.4 - 21.4	PVC Pipe
3	+ 3.0 - 6.4	PVC Pipe

Total Depth of Drilling 40.4' bgl
Formation Collapse Fill (top) 27.7' bgl
No. 1. Filtered, Washed Blast Sand (top) 18.6' bgl
Bentonite Compressed into pellets (top) 15.0' bgl
Portland Type I Neat Cement (0.8 bbls) Surface



Field Boring Log

Client: RADIAN CORPORATION	Job Number: 84-833	Boring Number: MW-2
Project/Location: Bergstrom AFB / Austin, TX		Sheet 1 of 2
Surface Elevation: / Groundwater Depth / Date: 31.98 TOC / 4/3/84 1030 hrs	Total Depth Drilled: 41.5	Date Drilled: 3/22/84
Drilling and Sampling Methods: Hollow Stem, Free-Flight Augers		Logged By: Robert L. Sherrill
SS - Split Spoon ST - Shelby Tube		Contractor/Crew: Radian/USL
Comments: See Back of This Page for Monitor Well Details		Drilling Rig Model: Mobil B-53

Sample Number	Depth (Feet)	Sample Type	Sample Disposition: Length	Container (J/B/D)	Number	Blows and/or Recovery	Symbol	Sample Description
1	0-1.5	ST	1.5	B	A056	0-1.5	CL	SANDY CLAY low plasticity, 20% very fine sand, 10% caliche in zones, hard pp > 4.0 kg/cm², brown, damp, organic
2	5-6.5	ST	1.5	B	A057	5-6.5	SP	SAND uniform fine, minor clay, compact, damp, brown, no odor, sand is subrounded
3	10-11.5	ST	1.5	B	A058	10-11.5	SC	CLAYEY SAND similar to above except 15% clay
								Sediment Change at 14.0' bgl
4	15-16.5	ST	1.5	B	A059	15-16.5	SP	GRAVELLY SAND uniform fine sand, 10-15% small gravel, compact, very moist to saturated, brown, no odor
								16.1'-16.2' = Saturated zone
								Saturated zone in sample #4 is 3" thick and Perched
5	20-21.5	SS	1.5	B	A060	15/6 35/6 35/6 N=70	GP	GRAVEL uniform fine gravel, loose, saturated, brown, no odor
								Top of Saturated Zone at 19.0' bgl

Underground Resource Management, Inc.
Austin, Texas

Field Boring Log

Client: Radian Corporation		Job Number: 84-833	Boring Number: MW-2
Project/Location: Bergstrom AFB. /Austin, TX			Sheet 2 of 2
Surface Elevation	Groundwater Depth / Date	Total Depth Drilled	Date Drilled: 3/22/84
Drilling and Sampling Methods			Logged By: Robert L Sherrill
			Contractor/Crew: Radian / JSL
Comments			Drilling Rig Model: Mobil B-53

Sample Number	Depth (Feet)	Sample Type	Sample Disposition: Length	Container (J/B/D)	Number	Blows and/or Recovery	Symbol	Sample Description
6	25-26.5	SS	1.5	B	A061	20/6 34/6 20/6	GP	GRAVEL similar to above
						N=54		
								Sediment Change at 29.5' bgl
7	30-31.5	SS	1.5	B	A062	23/6 37/6 53/6	CH	CLAY highly plastic, no sand, hard, saturated, green
						N=90		
8	35-36.5	ST	1.5	B	A063	35-36.5	CH	CLAY similar to above except dry
9	40-41.6	ST	1.6	B	A064	40-41.6	CH	CLAY similar to above

Underground Resource Management, Inc.
Austin, Texas

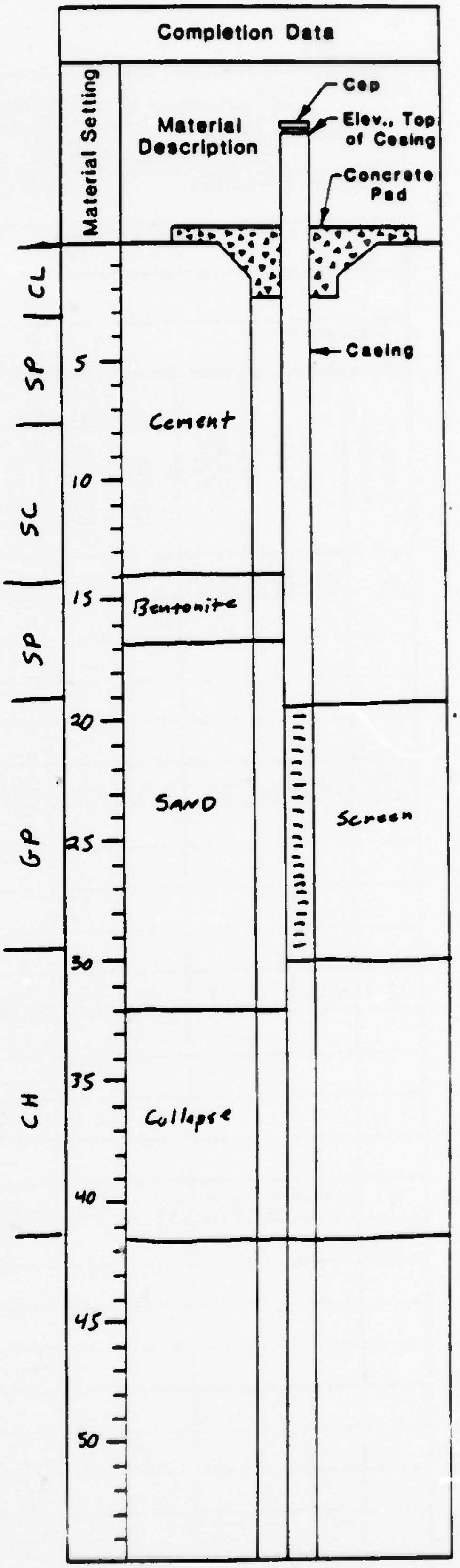
Monitor Well #2

Screen is 10' Wire Wrapped Stainless Steel by Smith Screens. Screen is 4" I.D.

Pipe is 4" I.D. Sch 40 PVC with flush joints

Joint #	Setting (bsl)	Type
1	19.6 - 30.0	Stainless Steel Screen
2	4.9 - 19.6	PVC Pipe
3	+4.8 - 4.9	PVC Pipe

Total Depth of Drilling 41.5' bsl
Formation Collapse (top) 32.0' bsl
No. 1 Filtered, Washed, Blast Sand (top) 16.8' bsl
Bentonite Compressed into Pellets (top) 14.0' bsl
Portland Type I Neat Cement (0.6 bbls) Surface



Field Boring Log

Client: RADIAN CORPORATION		Job Number: 84-833	Boring Number: MW-3
Project/Location: Bergstrom A.F.B. / Austin, TX			Sheet 1 of 3
Surface Elevation	Groundwater Depth / Date: 28.08' TOC / 4/13/84 1115 hrs	Total Depth Drilled: 36.5'	Date Drilled: 3/26/84
Drilling and Sampling Methods: Hollow Stem, Free-Flight Augers			Logged By: Robert L. Sherrill
SS- Split Spoon ST- Shelby Tube			Contractor/Crew: Radian / JSL
Comments: See Back of This Page for Monitor Well Details			Drilling Rig Model: Mobil B-53

Sample Number	Depth (Feet)	Sample Type	Sample Disposition: Length	Container (J/B/D)	Number	Blows and/or Recovery	Symbol	Sample Description
1	0-1.5	ST	1.5	B	A065	0-1.5	CL	SANDY CLAY low plasticity, 20% very fine sand, 20% calichified zones, very stiff pp = 3.5 kg/cm², damp, medium brown to dark brown, sand is in matrix
2	2.5-4.0	ST	1.5	B	A066	2.5-4.0	CL	SANDY CLAY similar to above except it has no caliche and sand is in pocket. Note: bottom 0.01' of sample is a silty sand
3	5.0-6.5	ST	1.5	B	A067	5.0-6.5	SM	SILTY SAND poorly graded, 80% very fine sand with 20% silt in matrix, very minor scattered caliche nodules, compact, damp, light brown
4	7.5-9.0	ST	1.5	B	A068	7.5-9.0	SM	SILTY SAND similar to above
5	10.0-11.5	ST	1.5	B	A069	10.0-11.5	SM	SILTY SAND similar to above
								TOP OF SATURATED ZONE AT 12.5' bgl

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Field Boring Log

Client	Job Number	Boring Number
RADIAN CORPORATION	84-833	MW-3

Project/Location	Sheet
Bergstrom A.F.B. / Austin, TX	2 of 3

Surface Elevation	Groundwater Depth / Date	Total Depth Drilled	Date Drilled
		36.5'	3/26/84

Drilling and Sampling Methods	Logged By
	Robert Sherrill
	Contractor/Crew Radian / JSL
Comments	**Drilling Rig Model** Mobil B-53

Sample Number	Depth (Feet)	Sample Type	Sample Disposition: Length	Container (J/B/D)	Number	Blows and/or Recovery	Symbol	Sample Description
6	12.5-14.0	ST	1.5	B	A070	12.5-14	SM	SILTY SAND similar to above except saturated
								Sediment Change at 14.5' bgl
7	15-16.5	ST	1.5	B	A071	15-16.5	SP	SAND uniform medium sand, minor silt, compact to loose, brown, saturated
								Sediment Change at 19.0' bgl
8	20-21.5	SS	1.5	B	A072	37/6 43/6 48/6 N=91	GP	GRAVEL uniform small angular to subangular gravel, minor very fine sand, loose, saturated, limestone and chert gravel
9	25-26.5	SS	1.5	B	A073	9/6 20/6 41/6 N=61	GP	GRAVEL (25.0-26.0) similar to above
							CH	CLAY (26.0-26.5) highly plastic, hard, saturated, green and brown
10	30-31.5	ST	1.5	B	A074	30-31.5	CH	CLAY similar to above

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Field Boring Log

Client: RADIAN CORPORATION		Job Number: 84-833	Boring Number: MW-3
Project/Location: Bergstrom A.F.B. / Austin, TX			Sheet 3 of 3
Surface Elevation	Groundwater Depth / Date	Total Depth Drilled: 36.5'	Date Drilled: 3/26/84
Drilling and Sampling Methods			Logged By: Robert L. Sherrill
			Contractor/Crew: Radian / USL
Comments			Drilling Rig Model: Mobil 13-53

Sample Number	Depth (Feet)	Sample Type	Sample Disposition: Length	Sample Disposition: Container (J/B/D)	Sample Disposition: Number	Blows and/or Recovery	Symbol	Sample Description
11	35-36.5	ST	1.5	B	A075	35-36.5	CH	CLAY similar to above except dry

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MONITOR WELL # 3

Screen is a 10.0' Wire Wrapped Stainless Steel, 4" ID, by Howard Smith Screens

Pipe is 4" ID Sch 40 PVC with Flush joints.

Joint #	Setting (bgl)	Type
1	26.0'-16.0'	Stainless Steel Screen
2	16.0'-1.0'	PVC Pipe
3	+8.7'-1.0'	PVC Pipe

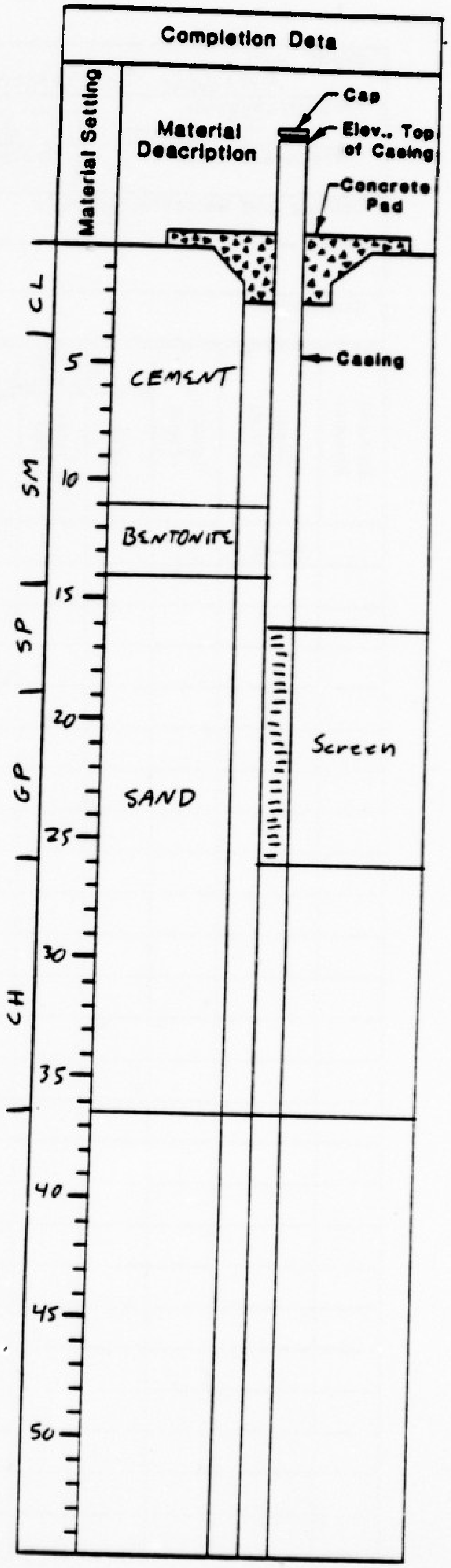
Total Depth of Drilling 36.5' bgl

Formation Collapse None

No.1 Filtered, Washed, Blast Sand (top) 14.0' bgl

Bentonite Compressed into Pellets (top) 11.0' bgl

Portland Type I Neat Cement (0.5 bbls) Surface



Field Boring Log

Client: RADIAN CORPORATION		Job Number: 84-833	Boring Number: MW-4
Project/Location: Bergstrom AFB / Austin, TX			Sheet 1 of 2
Surface Elevation:	Groundwater Depth / Date:	Total Depth Drilled: 31.5'	Date Drilled: 3/30/84
Drilling and Sampling Methods: Hollow-Stem, Free-Flight Augers			Logged By: Robert L. Sherrill
G-Grab SS-Split Spoon ST-Shelby Tube			Contractor/Crew: Radian / USL
Comments: See Back of This Page for Monitor Well Details			Drilling Rig Model: Mobil / B-53

Sample Number	Depth (Feet)	Sample Type	Sample Disposition: Length	Container (J/B/D)	Number	Blows and/or Recovery	Symbol	Sample Description
1	0-1.5	G	1.5	B	A111	0-1.5	CH	SILTY CLAY highly plastic, minor very fine sand in matrix, stiff, brown, organic, FILL
2	5-6.5	ST	1.5	B	A112	5-6.5	CH	SILTY CLAY similar to above, contains paper and plastic, very strong garbage odor FILL
								Sediment Change (bottom of fill) 8.5' bgl
3	10-11.5	ST	1.5	B	A113	10-11.5	SP	SAND uniform medium sand, no fines, loose, dry, brown, subrounded grains
								Sediment Change at 12.0' bgl
4	15-16.5	ST	1.5	B	A114	15-16.5	SP	GRAVELLY SAND similar to above except 10% medium subrounded gravel
								Sediment Change at 17.0' bgl
5	20-21.5	ST	1.5	B	A115	20-21.5	CH	CLAY highly plastic, hard pp >4.0 kg/cm², brown, damp

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Field Boring Log

Client	Job Number	Boring Number
Radian Corporation	84-833	MW-4
Project/Location Bergstrom AFB / Austin, TX		**Sheet** 2 **of** 2
Surface Elevation	**Groundwater Depth / Date**	**Total Depth Drilled** 31.5'	**Date Drilled** 3/30/84
Drilling and Sampling Methods		**Logged By** Robert L. Sherrill
		Contractor/Crew Radian / USL
Comments		**Drilling Rig Model** Mobil B-53

Sample Number	Depth (Feet)	Sample Type	Sample Disposition: Length	Sample Disposition: Container (J/B/D)	Sample Disposition: Number	Blows and/or Recovery	Symbol	Sample Description
6	25-26.5	ST	1.5	B	A116	25-26.5	CH	CLAY similar to above except
								brown and darkgreen
7	30-31.5	ST	1.5	B	A117	30-31.5	CH	CLAY similar to above

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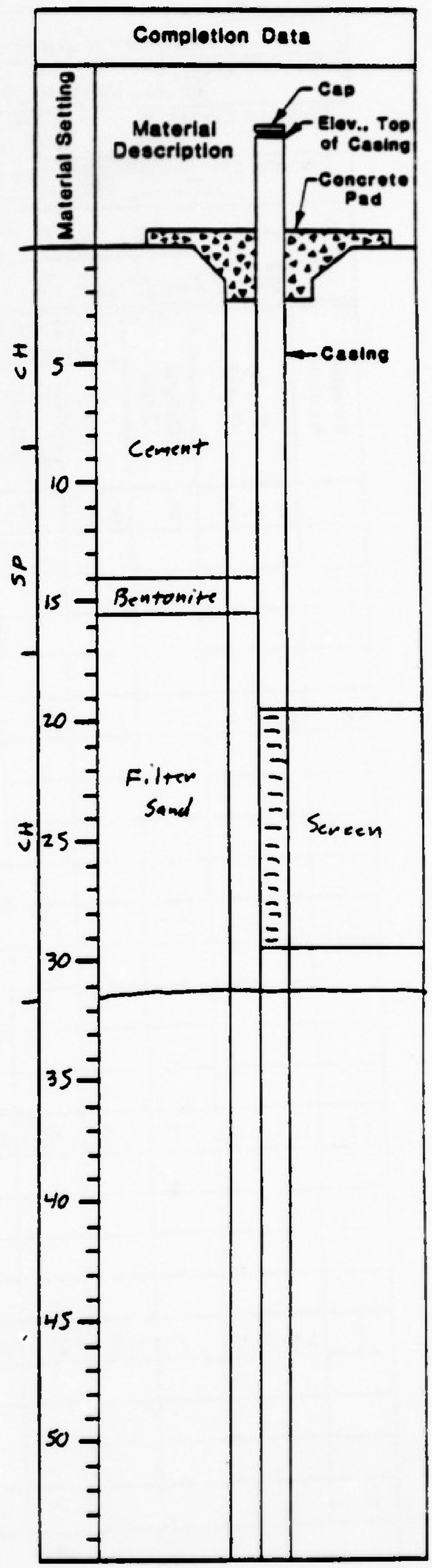
MONITOR WELL #4

Screen is 10' Wire Wrapped Stainless Steel with a 4" I.D. by Howard Smith Screen

Pipe is 4" I.D. Sch 40 PVC with Flush threaded Joints

Joint #	Setting (bgl)	Type
1	19.6'-29.6'	stainless Steel Screen
2	4.8'-19.6'	PVC Pipe
3	+4.9'-4.8'	PVC Pipe

Total Depth of Drilling	31.5' bgl
Formation Collapse (top)	None
No. 1, Filtered, Washed Blast Sand (top)	15.6' bgl
Bentonite Compressed into Pellets (top)	14.0' bgl
Portland Type I Neat Cement (0.75 ~~bls~~)	Surface



Field Boring Log

Client: RADIAN CORPORATION	Job Number: 84-833	Boring Number: MW-5
Project/Location: Bergstrom AFB / Austin, TX		Sheet 1 of 2
Surface Elevation:	Groundwater Depth / Date: 44.06' TOC / 4/2/84 1200 hrs / Total Depth Drilled: 41.5	Date Drilled: 3/27/84
Drilling and Sampling Methods: Free-Flight, Hollow Stem Augers		Logged By: Robert L. Sherrill
G-Grab SS-Split Spoon ST-Shelby Tube		Contractor/Crew: Radian / USL
Comments: See Back of This Page for Monitor Well Details		Drilling Rig Model: Mobil B-53

Sample Number	Depth (Feet)	Sample Type	Sample Disposition: Length	Container (J/B/D)	Number	Blows and/or Recovery	Symbol	Sample Description
1	0-1.5	G	1.5	B	A088	0-1.5	CH	SILTY CLAY highly plastic, minor gravel, stiff, brown, damp, FILL
2	5-6.5	ST	1.5	B	A089	5-6.5	CH	SILTY CLAY similar to above except contains metal and glass pieces, no odor, FILL
								Bottom of Fill is at 9.0'
3	10-11.5	ST	1.5	B	A090	10-11.5	CH	CLAY highly plastic, minor caliche nodules, hard pp > 4.0 kg/cm², green, damp
4	15-16.5	ST	1.5	B	A091	15-16.5	CH	SILTY CLAY highly plastic, 20% caliche in zones, hard pp > 4.0 kg/cm², green, damp
5	20-21.5	ST	1.5	B	A092	20-21.5	CH	SILTY CLAY similar to above except minor caliche, very stiff pp = 3.5 kg/cm²

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Field Boring Log

Client	Job Number	Boring Number
RADIAN CORPORATION	84-833	MW-5
Project/Location: Bergstrom AFB / Austin, TX		Sheet 2 of 2
Surface Elevation / Groundwater Depth / Date	Total Depth Drilled: 41.5	Date Drilled: 3/27/84
Drilling and Sampling Methods		Logged By: Robert L. Sherrill
		Contractor/Crew: Radian / JSL
Comments		Drilling Rig Model: Mobil B-53

Sample Number	Depth (Feet)	Sample Type	Sample Disposition: Length	Container (J/B/D)	Number	Blows and/or Recovery	Symbol	Sample Description
6	25-26.5	ST	1.5	B	A093	25-26.3	CH	SILTY CLAY similar to above
7	30-31.6	ST	1.5	B	A094	30-31.6	CH	CLAY highly plastic, no course material, hard pp 74.0 kg/cm², brown and grey, damp
8	35-36.5	ST	1.5	B	A095	35-36.5	CH	CLAY highly plastic, no course material hard pp 74.0 kg/cm², dark green, dry, slip zone with Slickensides
9	40-41.5	ST	1.5	B	A096	40-41.5	CH	CLAY similar to above

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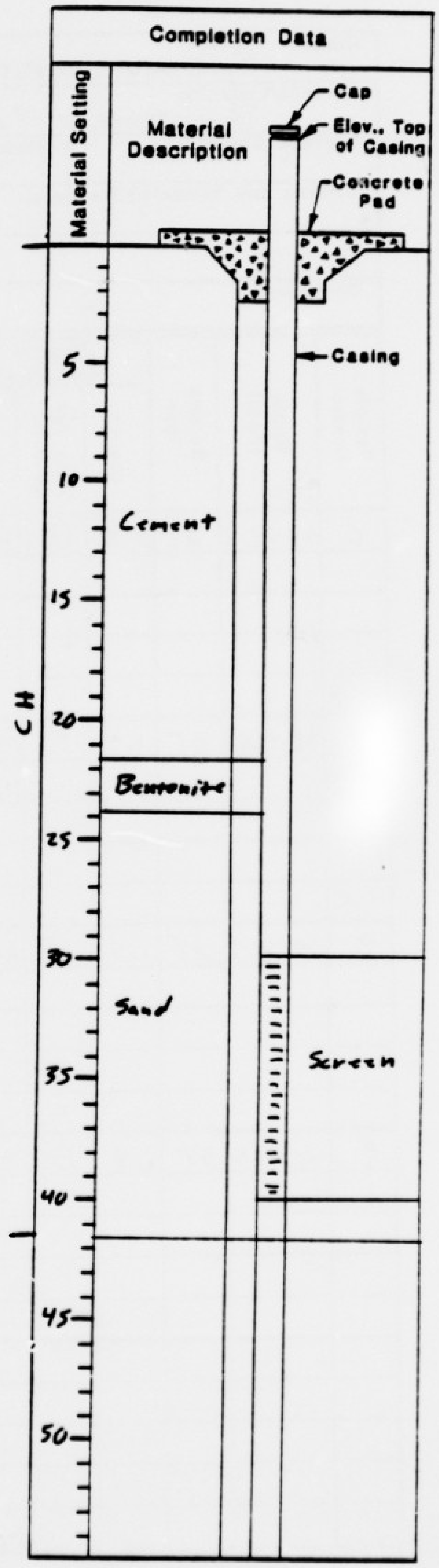
Monitor Well #5

Screen is 10.1' Wire Wrapped Stainless Steel, 4" I.D. Howard Smith Screen.

Pipe is 4" I.D. Sch 40 PVC with flush threads

Joint #	Setting (bsl)	Type
1	29.9 - 40.0	Stainless Steel Screen
2	15.0 - 29.9	PVC Pipe
3	5.3 - 15.0	PVC Pipe
4	+4.4 - 5.3	PVC Pipe

Total Depth of Drilling	41.5' bsl
Formation Collapse (top)	None
No. 1 Filtered, Washed, Blast Sand	23.8' bsl
Bentonite Compressed into Pellets	21.6' bsl
Portland Type I Neat Cement (1.4 bbls)	Surface



Field Boring Log

Client	Job Number	Boring Number
RADIAN CORPORATION	84-833	MW-6
Project/Location Bergstrom AFB / Austin, TX		**Sheet** 1 **of** 2
Surface Elevation / **Groundwater Depth / Date** 27.41	**Total Depth Drilled** 31.5'	**Date Drilled** 3/30/84
Drilling and Sampling Methods Hollow Stem, Free-Flight Augers		**Logged By** Robert L. Sherrill
G-Grab SS-Split Spoon ST-Shelby Tube		**Contractor/Crew** Radian/USL
Comments See Back of this Page for Monitor Well Details		**Drilling Rig Model** Mobil B-53

Sample Number	Depth (Feet)	Sample Type	Sample Disposition: Length	Container (J/B/D)	Number	Blows and/or Recovery	Symbol	Sample Description
1	0-1.5	G	1.5	B	A104	0-1.5	SM	SILTY SAND poorly graded, 80% very
								fine sand, 20% silt, compact,
								dry, brown
								Sediment Change at 4.0' bgl
2	5-6.5	ST	1.5	B	A105	5-6.5	CH	SILTY CLAY highly plastic, 20% silt,
								hard pp > 4.0 Kg/cm², damp, brown
								Sediment Change at 9.5' bgl
3	10-11.5	ST	1.5	B	A106	10-11.5	SP	SAND uniform fine sand, minor silt
								in matrix, compact, dry, brown
								Sediment Change at 14.0' bgl
4	15-16.5	ST	1.5	B	A107	15-16.5	GP	GRAVEL poorly graded, 50% medium
								and 50% small angular to subangular
								gravel, loose, damp, gravel is
								chert and limestone
								Top of Saturated zone at 17.0' bgl
5	20-20.8	ST	0.8	B	A108	20-20.8	GP	GRAVEL similar to above except
								saturated
								Sediment Change at 24.5' bgl

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Austin, Texas

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Field Boring Log

Client: RADIAN CORPORATION	Job Number: 84-833	Boring Number: MW-6
Project/Location: Bergstrom AFB / Austin, TX		Sheet 2 of 2
Surface Elevation:	Groundwater Depth / Date:	Total Depth Drilled: 31.5'	Date Drilled: 3/30/84
Drilling and Sampling Methods:		Logged By: Robert L. Sherrill
		Contractor/Crew: Radian / USL
Comments:		Drilling Rig Model: Mobil B-53

Sample Number	Depth (Feet)	Sample Type	Sample Disposition: Length	Container (J/B/D)	Number	Blows and/or Recovery	Symbol	Sample Description
6	25-26.5	ST	1.5	B	A109	25-26.5	CH	CLAY highly plastic, no course material, hard, dark green, dry, has shear zones with slickensides
7	30-31.5	ST	1.5	B	A110	30-31.5	CH	CLAY similar to above
								When Pulling the Augers, they appeared to have areas with an oily sheen.

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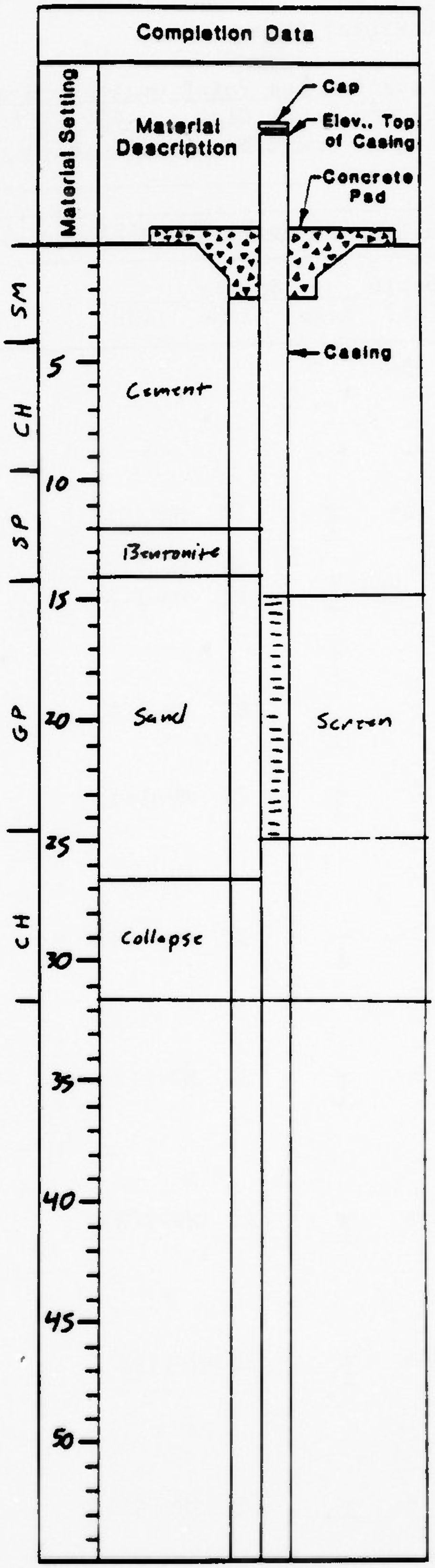
MONITOR WELL #6

Screen is 10' Wire Wrapped Stainless Steel with a 4" I.D. by Howard Smith Screens.

Pipe is 4" I.D. Sch 40 PVC with Flush Threaded Joints

Joint #	Setting (bgl)	Type
1	15.0'-25.0'	Stainless Steel Screen
2	0.1'-15.0'	PVC Pipe
3	+9.8'-0.1'	PVC Pipe

Total Depth of Drilling	31.5' bgl
Formation Collapse (top)	26.5' bgl
No. 1 Filtered, Washed, Blast Sand (top)	14.0' bgl
Bentonite Compressed into Pellets (top)	12.0' bgl
Portland Type I Neat Cement (0.6 bbl)	Surface



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Drilling Log

Boring or Well No. CH-7/MW-7
Sheet 1 of 1

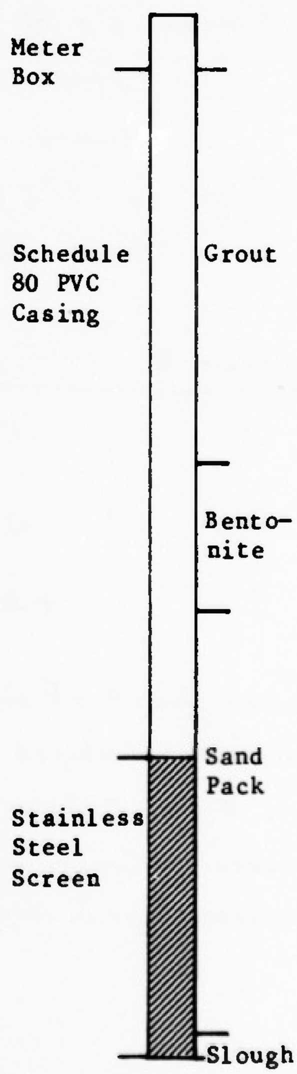
Location Low Point Drain by Bldg. 4544
Ground Level Elev.: 491.03 ft. MSL (topo)
Log Recorded by Pat Goodson
Comments:

G:Grab/SS:Split Spoon/ST:Shelby Tube

Project Bergstrom AFB IRP Phase II Stage 1
Beginning 2/20/85 and end 2/20/85 of drilling operation
Sampling Interval (Estimated) Variable (ft)
Drill Rig Mobile B-53
Drill Operator Jose Landeros

Depth (ft)	Sample Zone	Sample Type	Sample ID#	Lithologic Description
+5				
0	I	ST	MW-1(1)	CLAY; gravelly, tan and black, stiff, moist, gravel (20-30%).
		ST	MW-1(2)	CLAY; same as above.
	I	ST	MW-1(3)	CLAY; black, moist, gravel; present but less than above.
5	I			
		ST	MW-1(4)	CLAY; same as above.
	I			
10	I	ST	MW-1(5)	CLAY; slight gravel, light brown and tan clay, stiff. GRAVEL; noted at 11 feet.
15	I	ST	MW-1(6)	CLAY; gravelly, tan, soft, crumbly, moist gravel (30-40%).
20	I	ST	MW-1(7)	CLAY; same as above but less crumbly.
25	I	ST	MW-1(8)	CLAY; same as above.
30	I	ST	MW-1(9)	CLAY; tan, some iron staining, stiff, moist.
35	I	ST	MW-1(10)	CLAY; black, dry, clam shells. TD: 35 feet. Drager hydrocarbon test showed high concentration. The Drager test was performed after total depth. Testing was done through the surface opening on the hollow stem auger and completed well.
40				

Completion Schematic



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Boring Completion Log: Sheet 1 of 1

Boring or Well No. CH-7/MW-7
Project Bergstrom AFB IRP 212-027-11
Location Site 9
Log Recorded by Peter A. Waterreus

Construction

Construction Started 2/20/85
Completed 2/20/85
Total Depth Drilled (ft) 35.0
Hole Diameter 8-inch
Drilling Method Free flight hollow-stem auger (Mobile B-53 rig)
Problems encountered during drilling/completion None

Water source for drilling and completion procedures Bergstrom AFB potable supply

Sampling

Number, type and disposition of samples collected 10 Shelby tube

Sample interval (ft-ft) 0.0-1.0, 2.5-3.5, 5.0-6.0, 7.5-8.5, 10.0-11.0, 15.0-16.0, 20.0-21.0, 25.0-26.0, 30.0-31.0, 35.0-35.5
Storage and/or preservation method(s) Clear glass quart jar and lid

Materials

Casing type Schedule 80 PVC
Diameter 2-inch (internal)
Top of well casing (ft-AGL/BGL) 0.2 BGL
Elevation (ft-msl) 490.83
Depth of casing (ft) 25.0
Screen type Stainless steel wrap
Diameter 2-inch (internal)
Slot size 0.01 inch
Screen interval (ft-ft) 25.0-35.0

Type(s) of glue used to join casing None - threaded flush joint couplings
Type of gravel/sand pack used Clemtex No. 2 (8-40 mesh)
Amount of gravel pack used 6 sacks
Grain size distribution of gravel pack Retained #8 (2.0%), #16 (51.2%), #20 (62.8%)[1]
Lithology of gravel pack Mostly silica (94%)
Source (company and quarry/pit) Clemtex, Inc., Houston, Texas

Interval of gravel pack (ft-ft) 20.0-34.5 (0.5 ft. slough)
Interval of bentonite seal (ft-ft) 15.0-20.0
Interval of grouting (ft-ft) 1.5-15.0

Comments

Type of bentonite - pellets
Type of grout - Portland Type 1 (neat cement)
[1]#30 (78.4%), #40 (91.2%), #50 (98.9%), #100 (100.0%)

Description of Security Measures

Keyed meter box flush with the ground.

Padlock ID No. N/A
Location of key(s) Bergstrom AFB

RADIAN
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Drilling Log

Boring or Well No. MW-8
Sheet 1 of 1

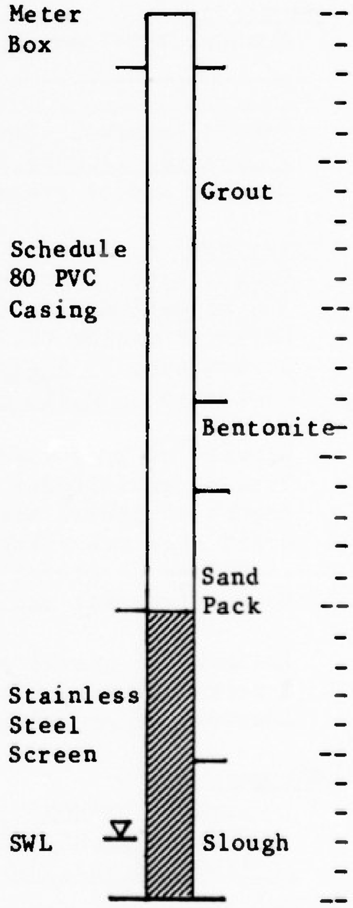
Location Low Point Drain by Bldg. 4544
Ground Level Elev.: 488.78 ft.MSL(topo)
Log Recorded by Pat Goodson
Comments:

G:Grab/SS:Split Spoon/ST:Shelby Tube

Project Bergstrom AFB IRP Phase II Stage 1
Beginning 2/21/85 and end 2/21/85 of drilling operation
Sampling Interval (Estimated) 5 (ft)
Drill Rig Mobile B-53
Drill Operator Jose Landeros

Depth (ft)	Sample Zone	Sample Type	ID#	Lithologic Description
+5				
0		G		CLAY; black, moist.
5	I	ST	MW-2(1)	CLAY; gravelly, tan, hard, dry, gravel (20-30%).
10	I	ST	MW-2(2)	SAND; clayey, gravelly, sand (60-70%) fine to medium grain size, moist, tan to yellow, gravel (20%), clay (15%).
15	I	ST	MW-2(3)	SAND; same as above.
20	I	ST	MW-2(4)	SAND; gravelly. Sand is fine to coarse grain size, loose, moist, yellow to brown. Gravel (30-35%).
25	I	ST	MW-2(5)	SAND; same as above but wet.
30	I	ST	MW-2(6)	CLAY; weathered bluish gray, stiff, moist. TD: 30 feet. Drager hydrocarbon test (negative). The Drager test was performed after total depth. Testing was done through the surface opening on the hollow stem auger and completed well.
35				
40				

Completion Schematic



RADIAN CORPORATION

Boring Completion Log: Sheet 1 of 2

Boring or Well No. MW-8 · Project Bergstrom AFB IRP 212-027-11
Location Site 9 Log Recorded by Peter A. Waterreus

Construction

Construction Started 2/21/85 Completed 2/21/85
Total Depth Drilled (ft) 30.0 Hole Diameter 8-inch
Drilling Method Free flight hollow-stem auger (Mobile B-53 rig)
Problems encountered during drilling/completion None

Water source for drilling and completion procedures Bergstrom AFB potable supply

Sampling

Number, type and disposition of samples collected 6 Shelby tube

Sample interval (ft-ft) 5.0-5.2, 10.0-10.5, 15.0-15.5, 20.0-20.5, 25.0-25.5, 30.0-30.4

Storage and/or preservation method(s) Clear glass quart jar and lid

Materials

Casing type Schedule 80 PVC Diameter 2-inch (internal)
Top of well casing (ft-AGL/BGL) 0.5 BGL Elevation (ft-msl) 488.28
Depth of casing (ft) 20.0
Screen type Stainless steel wrap Diameter 2-inch (internal)
Slot size 0.01 inch Screen interval (ft-ft) 20.0-30.0

Type(s) of glue used to join casing None - threaded flush joint couplings
Type of gravel/sand pack used Clemtex No. 2 (8-40 mesh)
Amount of gravel pack used 4 sacks
Grain size distribution of gravel pack Retained #8 (2.0%), #16 (51.2%), #20 (62.8%)[1]
Lithology of gravel pack Mostly silica (94%)
Source (company and quarry/pit) Clemtex, Inc., Houston, Texas

Interval of gravel pack (ft-ft) 16.0-25.0 (5.0 slough)
Interval of bentonite seal (ft-ft) 13.0-16.0
Interval of grouting (ft-ft) 1.5-13.0

Comments

Type of bentonite - pellet
Type of grout - Portland Type 1 (neat cement)
[1]#30 (78.4%), #40 (91.2%), #50 (98.9%), #100 (100.0%)

Description of Security Measures

Keyed meter box flush with the ground

Padlock ID No. N/A Location of key(s) Bergstrom AFB

RADIAN
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Well Completion Log: Sheet 2 of 2 (Development)

Development started 2/22/25 Development ended 2/22/85
Static level of water before 28.04 (ft) and after bailed dry (ft) development.
Measuring point (MP) description Top of casing

MP Height 0.5 BGL (ft) Elevation 488.28 MSL (ft)
Quantity of water discharged during development 0.3 gallon
Type, size/capacity of pump or bailer used for developmnt 0.284 ballon bailer

Depth of open hole inside well (below ground level on measuring point)
Before development 29.8 (ft) After development N/A (ft)

Date/Time	Discharge (GPM/Bail(s)) Note SWL	start/End.(1)	Field Measurements Temperature	Conductivity	pH	Remarks
2/25/85	SWL	28.04	22°C	710	*	pH meter not operating properly.
1145		0.3 gallon				Silty

NOTE: (1) Depth measurements made by Steel Tape (ST); Rope and Bailer (R/B) and Electric Line (EL).
(2) Temperature in degrees celsius.
(3) Conductivity in micromhos/centimeter at field temperature.

RADIAN CORPORATION

Drilling Log

Boring or Well No. MW-9
Sheet 1 of 2

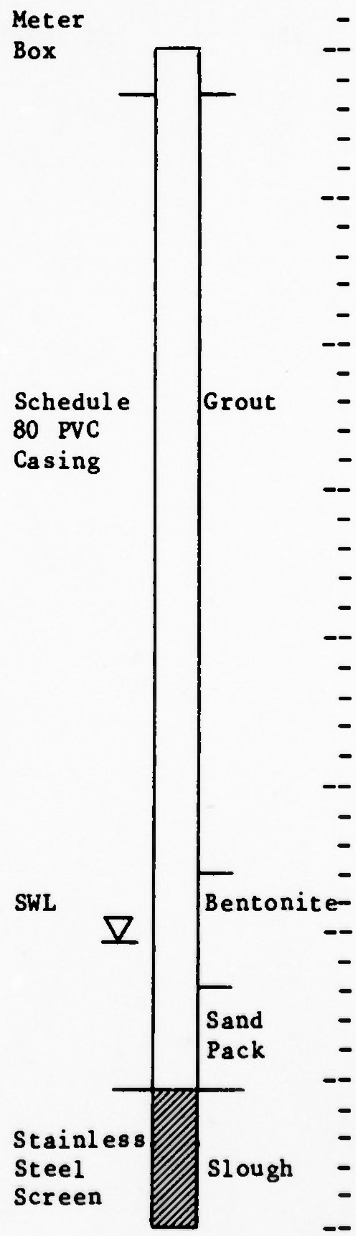
Location Low Point Drain by Bldg. 4544
Ground Level Elev.: 491.15 ft.MSL(topo)
Log Recorded by Pat Goodson
Comments:

G:Grab/SS:Split Spoon/ST:Shelby Tube

Project Bergstrom AFB IRP Phase II Stage 1
Beginning 2/21/85 and end 2/21/85 of drilling operation
Sampling Interval (Estimated) 5 (ft)
Drill Rig Mobile B-53
Drill Operator Jose Landeros

Depth (ft)	Sample Zone	Sample Type	Sample ID#	Lithologic Description
+5				
0		G		CLAY; gravelly. Clay is black, dense, moist, gravel (20-30%).
5	I	ST	MW-3(1)	CLAY; black, soft, moist, some iron stains.
10	I	ST	MW-3(2)	CLAY; gravelly, tan, stiff, moist, gravel (20-30%).
15	I	ST	MW-3(3)	CLAY; light brown to tan, soft, moist.
20	I	ST	MW-3(4)	CLAY; gravelly, tan, stiff, crumbly, slightly moist. Gravel (20-30%).
25	I	ST	MW-3(5)	SAND; light brown, fine to coarse grain size.
30	I	ST	MW-3(6)	SAND and GRAVEL; clayey. Well graded sands with a clay matrix, dense, slightly moist.
35	I	ST	MW-3(7)	SAND; clayey. Sand (70-80%), tan, loose, saturated, well graded.
40	I	ST	MW-3(8)	SAND; light brown, well graded, fine to very coarse size, loose, saturated.

Completion Schematic



Continued on next page

RADIAN
CORPORATION

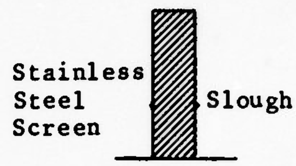
Drilling Log

Boring or Well No. MW-9
Sheet 2 of 2

Location Low Point Drain by Bldg. 4544
Ground Level Elev.: 491.15 ft.MSL(topo)
Log Recorded by Pat Goodson
Comments:

G:Grab/SS:Split Spoon/ST:Shelby Tube

Project Bergstrom AFB IRP Phase II Stage 1
Beginning 2/21/85 and end 2/21/85 of drilling operation
Sampling Interval (Estimated) 5 (ft)
Drill Rig Mobile B-53
Drill Operator Jose Landeros

Depth (ft)	Sample Zone	Sample Type	Sample ID#	Lithologic Description	Completion Schematic
40-				CLAY; at approximately 42 feet.	
45-	I	ST	MW-3(9)	CLAY; black, dry. TD: 45 feet. Drager hydrocarbon test (negative). The Drager test was performed after total depth. Testing was done through the surface opening on the hollow stem auger and completed well.	

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Boring Completion Log: Sheet 1 of 2

Boring or Well No. MW-9
Location Site 9
Project Bergstrom AFB IRP 212-027-11
Log Recorded by Peter A. Waterreus

Construction

Construction Started 2/21/85
Completed 2/21/85
Total Depth Drilled (ft) 45.0
Hole Diameter 8-inch
Drilling Method Free flight hollow-stem auger (Mobile B-53 rig)
Problems encountered during drilling/completion None

Water source for drilling and completion procedures Bergstrom AFB potable supply

Sampling

Number, type and disposition of samples collected 9 Shelby tube

Sample interval (ft-ft) 5.0-6.0, 10.0-11.0, 15.0-16.0, 20.0-20.5, 25.0-25.5, 30.0-30.5, 35.0-35.5, 40.0-40.5, 45.0-45.5
Storage and/or preservation method(s) Clear glass quart jar and lid

Materials

Casing type Schedule 80 PVC
Diameter 2-inch (internal)
Top of well casing (ft-AGL/BGL) 0.5 BLG
Elevation (ft-msl) 49.65
Depth of casing (ft) 35.0
Screen type Stainless steel wrap
Diameter 2-inch (internal)
Slot size 0.01 inch
Screen interval (ft-ft) 35.0-45.0

Type(s) of glue used to join casing None - threaded flush joint couplings
Type of gravel/sand pack used Clemtex No. 2 (8-40 mesh)
Amount of gravel pack used 2 sacks
Grain size distribution of gravel pack Retained #8 (2.0%), #16 (51.2%), #20 (62.8%)[1]
Lithology of gravel pack Mostly silica (94%)
Source (company and quarry/pit) Clemtex, Inc., Houston, Texas

Interval of gravel pack (ft-ft) 31.5-35.0 (10 ft. slough)
Interval of bentonite seal (ft-ft) 28.0-31.5
Interval of grouting (ft-ft) 1.5-28.0

Comments

Type of bentonite - Pellet
Type of grout - Portland Type 1 (neat cement)
[1]#30 (78.4%), #40 (91.2%), #50 (98.9%), #100 (100.0%)

Description of Security Measures

Keyed meter box flush with the ground.

Padlock ID No. N/A
Location of key(s) Bergstrom AFB

RADIAN CORPORATION

Well Completion Log: Sheet 2 of 2 (Development)

Development started 2/22/85 Development ended 2/22/85

Static level of water before 30.38 (ft) and after 30.04 (ft) development.

Measuring point (MP) description Top of casing

MP Height 0.5 BGL (ft) Elevation 490.65 MSL (ft)

Quantity of water discharged during development 40 Bails = 11.4 gallons

Type, size/capacity of pump or bailer used for developmnt 0.284 gallon bailer

Depth of open hole inside well (below ground level on measuring point)

Before development N/A (ft) After development N/A (ft)

Date/Time	Discharge (GPM/Bail(s)) Note SWL start/End.(1)	Field Measurements Temperature	Conductivity	pH	Remarks
	SWL 30.38				
2/25/85/	5 bails	23°C	720	*	pH meter was not
1210	10 bails	23°C	780		operating correctly.
	15 bails	23°C	790		All samples were
1225	20 bails	23°C	790		silty.

NOTE: (1) Depth measurements made by Steel Tape (ST); Rope and Bailer (R/B) and Electric Line (EL).

(2) Temperature in degrees celsius.

(3) Conductivity in micromhos/centimeter at field temperature.

Field Boring Log

Client: RADIAN CORPORATION		Job Number: 84-833	Boring Number: CH-1
Project/Location: BERGSTROM AFB / Austin, Tx			Sheet 1 of 3
Surface Elevation	Groundwater Depth / Date	Total Depth Drilled: 46.7'	Date Drilled: 3/19/84
Drilling and Sampling Methods: Hollow Stem Free-Flight Augers			Logged By: Robert L. Sherrill
SS - Split Spoon ST - Shelby Tube			Contractor/Crew: Radian / JSL
Comments: See Back of this Page for Temporary Well details			Drilling Rig Model: Mobil B-53

Sample Number	Depth (Feet)	Sample Type	Sample Disposition: Length	Container (J/B/D)	Number	Blows and/or Recovery	Symbol	Sample Description
1	0-1.5	SS	1.5	J	A001	0-1.5	SP	SAND uniform fine, minor clays, loose
						1/6 4/6 3/6		to compact, dark brown, damp, no odor
						N=7		
2	2.5-4.0	ST	1.5	J	A002	2.5-4.0	SP	SAND similar to above
3	5-6.5	ST	1.5	J	A003	5.0-6.5	SP	SAND poorly graded, 10% course sand,
								90% fine sand, no clays, loose,
								dark brown, saturated, no odor
								Saturated zone 5.3' to 7.0'
								Sediment Change at 7.0'
4	7.5-9.0	ST	1.5	J	A004	7.5-9.0	SM	SILTY SAND poorly graded, 65% very fine
								sand, 35% silt, dense, brown, moist,
								no odor, slight oily sheen
5	10-11.5	ST	1.5	J	A005	10.0-11.5	SM	SILTY SAND similar to above except
								has a slight gasolene odor

Underground Resource Management, Inc.
Austin, Texas

Field Boring Log

Client	Job Number	Boring Number
RADIAN CORPORATION	84-833	CH-1

Project/Location	Sheet
BERGSTROM AFB / AUSTIN, TX	2 of 3

Surface Elevation	Groundwater Depth / Date	Total Depth Drilled	Date Drilled
			3/19/84

Drilling and Sampling Methods	Logged By
	Robert L. Sherrill
	Contractor/Crew: Radian / JSL
Comments	Drilling Rig Model: Mobil B-53

Sample Number	Depth (Feet)	Sample Type	Sample Disposition: Length	Container (J/B/D)	Number	Blows and/or Recovery	Symbol	Sample Description
6	12.5-14	ST	1.5	J	A006	12.5-14.0	SM	SILTY SAND similar to above except has very slight gasolene odor
7	15.0-16.5	ST	1.5	J	A007	15.0-16.5	SM	SILTY SAND similar to above except has a strong gasolene odor
								SM has a gradational change into ML
8	17.5-19.0	ST	1.5	J	A008	17.5-19.0	ML	SANDY SILT low plasticity, 15-20% very fine sand, hard pp >4.0 Kg/cm², brown, damp, slight odor
								Sediment change at approx. 19.5'
9	20.0-21.5	ST	1.5	J	A009	20.0-21.5	CH	SILTY CLAY highly plastic, no sand, hard pp >4.0 Kg/cm², brown, damp, minor caliche, no odor
10	25-26.2	ST	1.2	J	A010	25.0-26.2	CH	CLAY similar to above except 2-5% silt

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Austin, Texas

Field Boring Log

Client	Job Number	Boring Number
RADIAN CORPORATION	84-833	CH-1
Project/Location: BERGSTROM AFB / AUSTIN, TX		Sheet 3 of 3
Surface Elevation / Groundwater Depth / Date / Total Depth Drilled		Date Drilled: 3/19/84
Drilling and Sampling Methods		Logged By: Robert L. Sherrill
		Contractor/Crew: Radian / USL
Comments		Drilling Rig Model: Mobil B-53

Sample Number	Depth (Feet)	Sample Type	Sample Disposition: Length	Container (J/B/D)	Number	Blows and/or Recovery	Symbol	Sample Description
11	30-31.3	ST	1.3	J	A011	30.0-31.3	CH	CLAY similar to above except has
								black organic dendrites
12	35-36.1	ST	1.1	J	A012	35.0-36.1	CH	CLAY highly plastic, no sand, no silt,
								hard pp >4.0 Kg/cm², dry, brown
								and grey, some minor matrix caliche
								no odor
13	40-41.3	ST	1.3	J	A013	40.0-40.3	CH	CLAY similar to above
				J	A013	40.3-41.3	SP	SAND uniform course sand, subrounded,
								loose, saturated, brown, no odor
14	45.0-45.2	ST	0.2	J	A014	45.0-45.2	GP	GRAVEL uniform small gravel, loose, subrounded
	45.2-46.7	SS	1.5	J	A014	29/6 42/6 57/6		saturated, no odor
						N=99		

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Austin, Texas

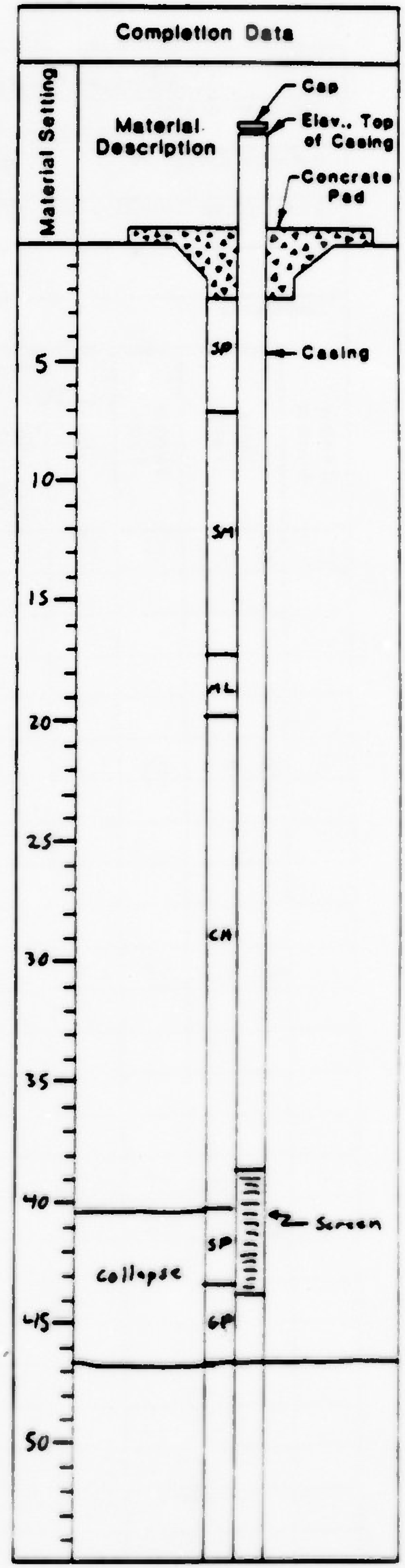
CH #1

Temporary Well is of 2.0" I. D. PVC Pipe
Pipe is Bell-End And was taped together with Duct tape

Bottom of Well is 43.7' bgl with slots cut into pipe from 38.7' bgl to 43.7' bgl

Collapse Tagged at 40.3' bgl

Casing and Screen temporary. Was pulled and hole grouted to surface.



Field Boring Log

Client: RADIAN CORPORATION	Job Number: 84-833	Boring Number: CH-2
Project/Location: Bergstrom AFB / Austin, TX		Sheet 1 of 2
Surface Elevation:	Groundwater Depth / Date:	Total Depth Drilled: 25.4' / Date Drilled: 3/20/84
Drilling and Sampling Methods: Hollow Stem Free-Flight Augers		Logged By: Robert L. Sharrill
SS - Split Spoon ST - Shelby Tube		Contractor/Crew: Radian / JSL
Comments: See Back of This Page for Temporary Well Details		Drilling Rig Model: Mobil B-53

Sample Number	Depth (Feet)	Sample Type	Sample Disposition: Length	Container (J/B/D)	Number	Blows and/or Recovery	Symbol	Sample Description
1	0-1.5	ST	1.5	J	A015	0-1.5	CH	CLAY highly plastic, no course material, very stiff pp = 2.5 Kg/cm², damp, brown with black discoloration, no odor
2	2.5-4.0	ST	1.5	J	A016	2.5-4.0	CH	CLAY similar to above except completely stained with oil, has a very strong hydrocarbon odor
3	5.0-6.5	ST	1.5	J	A017	5.0-6.5	CH	CLAY highly plastic, some minor scattered caliche nodules, very stiff pp = 2.75 Kg/cm², damp, grey color, slight hydrocarbon odor
4	7.5-9.0	ST	1.5	J	A018	7.5-9.0	CH	CLAY similar to above except brown with white seams of caliche, dry
5	10.0-11.5	ST	1.5	J	A019	10.0-11.5	CL	SANDY CLAY low plasticity, 15% very fine sand, hard pp >4.0 Kg/cm², brown with black organic spots, damp, minor calich, no odor

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Field Boring Log

Client: RADIAN CORPORATION	Job Number: 84-833	Boring Number: CH-2
Project/Location: BERGSTROM A.F.B. /Austin, TX		Sheet 2 of 2
Surface Elevation: / Groundwater Depth / Date: / Total Depth Drilled:		Date Drilled: 3/20/84
Drilling and Sampling Methods:		Logged By: Robert L. Sherrill
		Contractor/Crew: Radian / USL
Comments:		Drilling Rig Model: Mobil B-53

Sample Number	Depth (Feet)	Sample Type	Sample Disposition: Length	Container (J/B/D)	Number	Blows and/or Recovery	Symbol	Sample Description
6	12.5-14.3	ST	1.8	J	A020	12.5-14.3	CL	SANDY CLAY similar to above
7	15-16.3	ST	1.3	J	A021	15.0-16.3	CL	SANDY CLAY low plasticity, 25% fine sand, in pockets, hard pp >4.0 Kg/cm², damp green, increase in zonal caliche
8	17.5-18.6	ST	1.1	J	A022	17.5-18.6	CL	SANDY CLAY similar to above except moist
9	20.0-20.9	SS	0.9	J	A023	67/6 100/5 N: 100/5	GP	GRAVEL poorly graded, small to medium gravel, loose, saturated, no odor, chert and limestone gravel, gravel is subrounded Top of saturated zone is 19.5' Top of Gravel is 19.5'
10	25-25.4	ST	0.4	J	A024	25.0-25.4	CH	CLAY highly plastic, hard pp >4.0 Kg/cm² tan black organic dendrites, no odor

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Austin, Texas

CORE HOLE #2

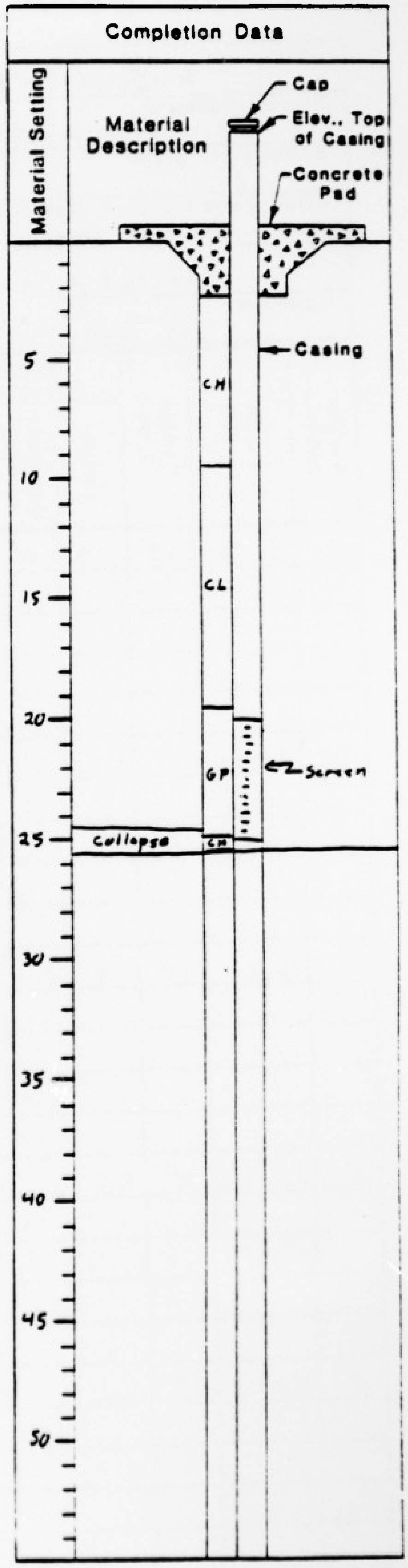
Well is of Slotted 2-in I.D Bell End PVC Pipe.

Pipe was taped together using Duct tape.

Bottom of well is 25.0' bgl with slots from 20.0' to 25.0' bgl

Collapse tagged at 24.6' bgl

Casing and Screen temporary. Was pulled and hole grouted 2 surface.



Field Boring Log

Client: RADIAN CORPORATION	Job Number: 84-833	Boring Number: CH-3
Project/Location: Bergstrom AFB / Austin, TX		Sheet 1 of 3
Surface Elevation:	Groundwater Depth / Date:	Total Depth Drilled: 31.5'
		Date Drilled: 3/20/84
Drilling and Sampling Methods: Hollow-Stem, Free-Flight Augers		Logged By: Robert L. Sherrill
SS - Split Spoon ST - Shelby Tube		Contractor/Crew: Radian / USL
Comments: See Back of This Page for Temporary Well Details		Drilling Rig Model: Mobil B-53

Sample Number	Depth (Feet)	Sample Type	Sample Disposition: Length	Container (J/B/D)	Number	Blows and/or Recovery	Symbol	Sample Description
1	0-1.5	ST	1.5	J	A025	0-1.5	CH	CLAY highly plastic, minor caliche nodules
								hard pp >4.0 kg/cm², moist, stained
								black with oily substance, very strong
								hydrocarbon odor
2	2.5-4.0	ST	1.5	J	A026	2.5-4.0	CH	CLAY similar to above
3	5.0-6.5	ST	1.5	J	A027	5.0-6.5	CL	SANDY CLAY low plasticity, 20% very fine
								sand, hard pp >4.0 kg/cm², brown,
								some scattered caliche nodules, moderate
								odor
4	7.5-9.0	ST	1.5	J	A028	7.5-9.0	CL	SANDY CLAY similar to above
								Sediment Change at 9.6'
5	10.0-11.1	ST	1.1	J	A029	10.0-11.1	ML	GRAVELLY SILT low plasticity, 25% small
								gravel, stiff pp = 1.75 kg/cm², brown,
								damp, moderate odor
								Sediment Change at 12.0'

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Austin, Texas

Field Boring Log

Client	Job Number	Boring Number
RADIAN CORPORATION	84-933	CH-3
Project/Location: Bergstrom A.F.B. / Austin, Tx		Sheet 2 of 3
Surface Elevation / Groundwater Depth / Date / Total Depth Drilled		Date Drilled: 3/20/84
Drilling and Sampling Methods		Logged By: Robert L. Sherrill
		Contractor/Crew: Radian / VSL
Comments		Drilling Rig Model: Mobil B-53

Sample Number	Depth (Feet)	Sample Type	Sample Disposition: Length	Container (J/B/D)	Number	Blows and/or Recovery	Symbol	Sample Description
6	12.5-14.0	SS	1.5	J	A030	33/6 28/6 29/6	GP	SANDY GRAVEL poorly graded, no fines,
						N: 57		75% subrounded medium gravel, 25%
								subrounded very fine sand, loose, dry,
								no odor, gravel is limestone origin
								Sediment Change is gradational
7	15.0-16.5	SS	1.5	J	A031	25/6 17/6 18/6	SP	GRAVELLY SAND poor grading, no fines,
						N: 35		35% subangular small gravel, 65% fine
								subrounded sand, loose, dry, no odor
8	17.5-19.0	SS	1.5	J	A032	10/6 17/- 34/6	SP	GRAVELLY SAND similar to above
						N: 51		
9	20-21.5	SS	1.5	J	A033	12/6 12/6 9/6	SP	GRAVELLY SAND similar to above except damp
						N: 21		
10	25-26.5	SS	1.5	J	A034	16/6 26/6 20/6	SP	SAND uniform subrounded course sand, minor
						N: 46		scattered medium gravel, loose, saturated,
								gravel is angular, no odor
								Top of Saturated Zone is 24.0'

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Austin, Texas

Field Boring Log

Client: Radian Corporation	Job Number: 84-833	Boring Number: CH-3
Project/Location: Bergstrom A.F.B. / Austin, TX		Sheet 3 of 3
Surface Elevation:	Groundwater Depth / Date:	Total Depth Drilled:
Date Drilled: 3/20/84		
Drilling and Sampling Methods:		Logged By: Robert L. Sherrill
		Contractor/Crew: Radian / JSL
Comments:		Drilling Rig Model: Mobil B-53

Sample Number	Depth (Feet)	Sample Type	Sample Disposition: Length	Container (J/B/D)	Number	Blows and/or Recovery	Symbol	Sample Description
11	30.0-31.5	SS	1.5	J	A035	26/6 21/6 19/6	SP	SAND similar to above (30.0-31.0)
						N=39	CH	CLAY highly plastic, no sand, hard
								pp>4.0 kg/cm², saturated, brown
								no odor (31.0-31.5)

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Austin, Texas

CORE HOLE #3

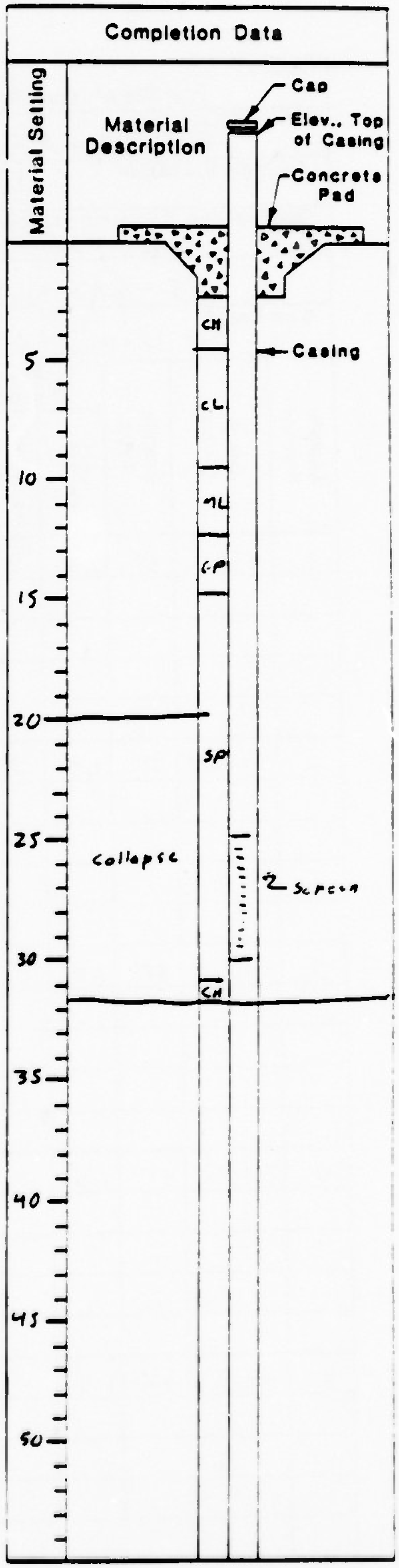
Slots cut in 2" ID P.V.C. bell-end Pipe.

Well set at 30.0' bgl with slots from 25.0'-30.0' bgl

Well is riveted together with 3/16" rivets with a 1/2" stroke

Collapse is at 20.00' bgl

Casing And Screen temporary. WAS pulled And hole grouted & surface.



Field Boring Log

Client	Job Number	Boring Number
RADIAN CORPORATION	84-833	CH-4

Project/Location	Sheet
BERGSTROM AFB / AUSTIN, TX	Sheet 1 of 3

Surface Elevation	Groundwater Depth / Date	Total Depth Drilled	Date Drilled
		31.5'	3/21/84

Drilling and Sampling Methods	
Hollow-Stem, Free-Flight Augers	Logged By: Robert L Sherrill
SS - Split Spoon ST - Shelby Tube	Contractor/Crew: Radian / JSL
Comments: See Detail (Back of This Page) On Temporary Well	Drilling Rig Model: Mobil B-53

Sample Number	Depth (Feet)	Sample Type	Sample Disposition: Length	Container (J/B/D)	Number	Blows and/or Recovery	Symbol	Sample Description
1	0-1.5	ST	1.5	J	A037	0-1.5	CH	CLAY highly plastic, no sand, minor scattered caliche nodules, hard pp >4.0 kg/cm², brown with black discoloration, moist strong hydrocarbon odor
2	2.5-4.0	ST	1.5	J	A038	2.5-4.0	CH	CLAY similar to above
3	5.0-6.5	ST	1.5	J	A039	5.0-6.5	CH	CLAY highly plastic, minor very fine sand in matrix, increased caliche content of ≈ 8%, hard pp >4.0 kg/cm², brown, damp, moderate hydrocarbon odor
4	7.5-9.0	ST	1.5	J	A040	7.5-9.0	CL	SANDY CLAY low plasticity, 15-20% very fine sand, minor caliche nodules, brown with black organic spots, moderate odor
5	10.0-11.5	ST	1.5	J	A041	10.0-11.5	CL	GRAVELLY CLAY low plasticity, 25% small gravel (subrounded), very stiff pp = 3.75 kg/cm², brown, damp, slight odor
								Sediment Change at 12.0'

Underground Resource Management, Inc.
Austin, Texas

Field Boring Log

Client	Job Number	Boring Number
RADIAN CORPORATION	84-833	CH-4

Project/Location	Sheet
BERGSTROM AFB / Austin, TX	2 of 3

Surface Elevation	Groundwater Depth / Date	Total Depth Drilled	Date Drilled
			3/21/84

Drilling and Sampling Methods	Logged By
	Robert L. Sherrill
	Contractor/Crew Radian / USL

Comments	Drilling Rig Model
	Mobil B-53

Sample Number	Depth (Feet)	Sample Type	Sample Disposition: Length	Container (J/B/D)	Number	Blows and/or Recovery	Symbol	Sample Description
6	12.5-14.0	SS	1.5	J	A042	21/6 38/6 27/6	SP	GRAVELLY SAND poorly graded, 20% angular
						N=65		medium gravel, 80% subrounded fine
								to medium sand, loose, dry, brown,
								no odor
7	15.0-16.5	SS	1.5	J	A043	22/6 30/6 21/6	SP	GRAVELLY SAND similar to above
						N=51		
8	17.5-19.0	SS	1.5	J	A044	17/6 41/6 37/6	SP	GRAVELLY SAND similar to above except
						N=79		gravel 30%
9	20-21.5	SS	1.5	J	A045	11/6 25/6 29/6	SP	GRAVELLY SAND similar to above except
						N=54		damp
								Top of the Saturated Zone at 24.3'
10	25.0-26.5	SS	1.5	J	A046	13/6 15/6 27/6	SP	GRAVELLY SAND similar to above except
								saturated

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Austin, Texas

Field Boring Log

Client: RADIAN CORPORATION	Job Number: 84-833	Boring Number: CH-4
Project/Location: Bergstrom AFB / Austin, TX		Sheet 3 of 3
Surface Elevation:	Groundwater Depth / Date: / Total Depth Drilled:	Date Drilled: 3/21/84
Drilling and Sampling Methods:		Logged By: Robert L. Sherrill
		Contractor/Crew: Radian / JSL
Comments:		Drilling Rig Model: Mobil B-53

Sample Number	Depth (Feet)	Sample Type	Sample Disposition: Length	Sample Disposition: Container (J/B/D)	Sample Disposition: Number	Blows and/or Recovery	Symbol	Sample Description
11	30-31.5	SS	1.5	J	4047	33/6 34/6 20/6	SP	GRAVELLY SAND (30.0-31.0) similar to above
						N=54	CH	CLAY (31.0-31.5) highly plastic, no sand,
								very stiff, saturated, grey, no odor

Underground Resource Management, Inc.
Austin, Texas

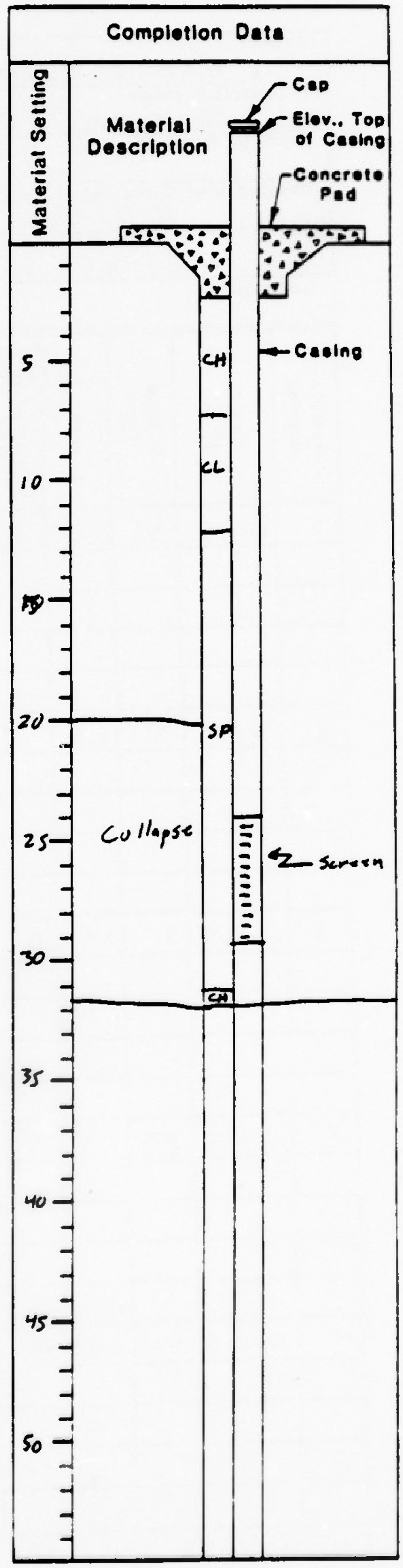
CORE HOLE # 4

2" PVC Pipe Slotted on Bottom 5'

Pipe is Rivited Together

Collapse at 20.0' bgl

Casing And Screen temporary. Was pulled and hole grouted to SURFACE.



Field Boring Log

Client: Radian Corporation	Job Number: 84-833	Boring Number: CH-5
Project/Location: Bergstrom A.F.B. /Austin, TX		Sheet 1 of 3
Surface Elevation:	Groundwater Depth / Date: / Total Depth Drilled: 60.4'	Date Drilled: 3/26/84
Drilling and Sampling Methods: Hollow-Stem, Free-Flight Augers		Logged By: Robert L. Sherrill
SS-Split Spoon ST-Shelby Tube		Contractor/Crew: Radian / JSL
Comments		Drilling Rig Model: Mobil B-53

Sample Number	Depth (Feet)	Sample Type	Sample Disposition: Length	Container (J/B/D)	Number	Blows and/or Recovery	Symbol	Sample Description
1	0-1.5	ST	1.5	B	A075	0-1.5	CH	CLAY highly plastic, minor very fine sand, hard pp > 4.0 Kg/cm², green and brown, damp
								Sediment Change at 3.5'
2	5-6.5	ST	1.5	B	A076	5-6.5	SM	SILTY SAND poorly graded, 60% very fine sand, 30% silt, 10% caliche nodules, dense, brown and white, damp
3	10-11.5	ST	1.5	B	A077	10-11.5	SM	SILTY SAND similar to above
								Sediment change at 14.0'
4	15-16.5	ST	1.5	B	A078	15-16.5	CL	GRAVELLY SANDY CLAY low plasticity, 10% caliche and chert rounded gravel, 20% medium subrounded sand, hard pp > 4.0 Kg/cm², damp, brown
								Sediment Change at 19.0'
5	20-21.5	ST	1.5	B	A079	20-21.5	CH	CLAY highly plastic, no course material, hard pp > 4.0 Kg/cm², damp, brown and grey

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Austin, Texas

URM-T20

Field Boring Log

Client	Job Number	Boring Number
RADIAN CORPORATION	84-833	CH-5
Project/Location: Bergstrom A.F.B. / Austin, TX		Sheet 2 of 3
Surface Elevation / Groundwater Depth / Date	Total Depth Drilled: 60.4'	Date Drilled: 3/26/84
Drilling and Sampling Methods		Logged By: Robert L. Sherrill
		Contractor/Crew: Radian / JSL
Comments		Drilling Rig Model: Mobil B-53

Sample Number	Depth (Feet)	Sample Type	Sample Disposition: Length	Container (J/B/D)	Number	Blows and/or Recovery	Symbol	Sample Description
6	25-26.5	ST	1.5	B	A080	25-26.5	CH	CLAY similar to above except green
								with minor scattered iron nodules
7	30-31.5	ST	1.5	B	A081	30-31.5	CH	CLAY similar to above except has a slip
								zone with Slickenside structures
								and with iron staining on up side
								and no iron staining on down side
8	35-36	ST	1.0	B	A082	35-36	CH	CLAY highly plastic, no course material,
								hard pp >4.0 kg/cm², damp, dark
								green
9	40-40.6	ST	1.6	B	A083	40-40.6	CH	CLAY similar to above
10	45-45.4	ST	0.4	B	A084	45-45.4	CH	CLAY similar to above

Underground Resource Management, Inc.
Austin, Texas

URM-T20

Field Boring Log

Client	Job Number	Boring Number
RADIAN CORPORATION	84-833	CH-5

Project/Location Bergstrom A.F.B. / Austin, TX	**Sheet** 3 **of** 3
Surface Elevation / **Groundwater Depth / Date** / **Total Depth Drilled** 60.4'	**Date Drilled** 3/26/84
Drilling and Sampling Methods	**Logged By** Robert L. Sherrill
	Contractor/Crew Radian / JSL
Comments	**Drilling Rig Model** Mobil B-53

Sample Number	Depth (Feet)	Sample Type	Sample Disposition: Length	Sample Disposition: Container (J/B/D)	Sample Disposition: Number	Blows and/or Recovery	Symbol	Sample Description
11	50-50.5	ST	0.5	B	A085	50-50.5	CH	CLAY similar to above
12	55-55.3	ST	0.3	B	A086	55-55.3	CH	CLAY similar to above
13	60-60.4	ST	0.4	B	A087	60-60.4	CH	CLAY similar to above

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Austin, Texas

URM-T20

Field Boring Log

Client: RADIAN CORPORATION	Job Number: 84-833	Boring Number: CH-6
Project/Location: Bergstrom AFB / Austin, TX		Sheet 1 of 2
Surface Elevation:	Groundwater Depth / Date:	Total Depth Drilled: 31.5	Date Drilled: 3/27/84
Drilling and Sampling Methods: Hollow-Stem, Free Flight, Augers		Logged By: Robert L. Sherrill
G-Grab SS-Split Spoon ST-Shelby Tube		Contractor/Crew: Radian/USL
Comments:		Drilling Rig Model: Mobil B-53

Sample Number	Depth (Feet)	Sample Type	Sample Disposition: Length	Container (J/B/D)	Number	Blows and/or Recovery	Symbol	Sample Description
1	0-1.5	ST	1.5	B	A097	0-1.5	CL	GRAVELLY CLAY low plasticity, 30% rounded medium gravel, stiff, damp grey
								Bottom of Fill at 4.0' bgl
2	5-6.5	ST	1.5	B	A098	5-6.5	CH	SILTY CLAY highly plastic, very minor small subrounded gravel, stiff pp=3.5 kg/cm brown, damp
								Sediment Change at 8.5' bgl
3	10-11.5	ST	1.5	B	A099	10-11.5	SP	SAND uniform medium subrounded sand, loose, dry, brownish red
								Sediment Change at 14.0' bgl
4	15.0-16.5	ST	1.5	B	A100	15.0-16.5	SP	GRAVELLY SAND similar to above except 30% medium angular limestone gravel, compact
								Sediment change at 18.0' bgl
5	20-21.5	ST	1.5	B	A101	20-21.5	CH	CLAY highly plastic, minor very fine sand in pockets, hard pp>4.0 kg/cm², brown with grey seams, very damp

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Austin, Texas

URM-T20

Field Boring Log

Client	Job Number	Boring Number
RADIAN CORPORATION	84-833	CH-6

Project/Location	Sheet
Bergstrom AFB / Austin, TX	2 of 2

Surface Elevation	Groundwater Depth / Date	Total Depth Drilled	Date Drilled
		31.5	3/27/84

Drilling and Sampling Methods	Logged By
	Robert L. Sherrill
	Contractor/Crew: Radian / VSL
Comments	Drilling Rig Model: Mobil B-53

Sample Number	Depth (Feet)	Sample Type	Sample Disposition: Length	Sample Disposition: Container (J/B/D)	Sample Disposition: Number	Blows and/or Recovery	Symbol	Sample Description
6	25-26.5	ST	1.5	B	A102	25-26.5	CH	CLAY (25.0-26.0) similar to above
							CH	CLAY (26.0-26.5) highly plastic, no sand,
								hard pp >4.0 kg/cm², seams of iron
								staining with some iron nodule
								development, dark green, damp
7	30-31.5	ST	1.5	B	A103	30-31.5	CH	CLAY similar to above (dark green)

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Austin, Texas

URM-T20

RADIAN
CORPORATION

Drilling Log

Boring or Well No. CH- 8
Sheet 1 of 1

Location Low Point Drain by Bldg. 4544
x Ground Level Elev.: ^490 ft.MSL(topo)
Log Recorded by Pat Goodson
Comments:

G:Grab/SS:Split Spoon/ST:Shelby Tube

Project Bergstrom AFB IRP Phase II Stage 1
Beginning 2/20/85 and end 2/20/85 of drilling operation
Sampling Interval (Estimated) 2.5 (ft)
Drill Rig Mobile B-53
Drill Operator Jose Landeros

Depth (ft)	Sample Zone	Sample Type	Sample ID#	Lithologic Description	Remarks
+5-					
0-		ST	C-2(1)	CLAY; slight gravel, black, soft, moist.	
2.5-		ST	C-2(2)	CLAY; gravelly, tan, stiff, moist, well graded gravel.	
5.0-		ST	C-2(3)	CLAY; gravelly, tan and black mottling, stiff, moist. Gravel (20-30%).	
7.5-		ST	C-2(4)	CLAY; sandy, light brown, soft, moist sand (20-30%).	
10-		ST	C-2(5)	CLAY; same as above. TD: 10 feet. Drager hydrocarbon test (negative). The Drager test was performed after total depth. Testing was done through the surface opening on the hollow-stem auger.	Abandonment of the boring was through backfilling of cuttings.

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Boring Completion Log: Sheet 1 of 1

Boring or Well No. CH-8
Location Site 9
Project Bergstrom AFB IRP 212-027-11
Log Recorded by Peter A. Waterreus

Construction

Construction Started 2/20/85
Completed 2/20/85
Total Depth Drilled (ft) 10.0
Hole Diameter 8-inch
Drilling Method Free flight hollow-stem auger (Mobile B-53 rig)
Problems encountered during drilling/completion

Water source for drilling and completion procedures Bergstrom AFB potable supply

Sampling

Number, type and disposition of samples collected 5 Shelby tube

Sample interval (ft-ft) 0.0-1.0, 2.5-3.5, 5.0-6.0, 7.5-8.5, 10.0-11.0

Storage and/or preservation method(s) Clear glass quart jar and lid

Materials

Casing type N/A
Diameter N/A
Top of well casing (ft-AGL/BGL) N/A
Elevation (ft-msl) N/A
Depth of casing (ft) N/A
Screen type N/A
Diameter N/A
Slot size N/A
Screen interval (ft-ft) N/A

Type(s) of glue used to join casing N/A
Type of gravel/sand pack used N/A
Amount of gravel pack used N/A
Grain size distribution of gravel pack N/A
Lithology of gravel pack N/A
Source (company and quarry/pit) N/A

Interval of gravel pack (ft-ft) N/A
Interval of bentonite seal (ft-ft) N/A
Interval of grouting (ft-ft) N/A

Comments

Backfilled to hole with cuttings.

Description of Security Measures

N/A

Padlock ID No. N/A
Location of key(s) N/A

RADIAN
CORPORATION

Drilling Log

Boring or Well No. CH-9
Sheet 1 of 1

Location Low Point Drain by Bldg. 4544
Ground Level Elev.: ^489 ft.MSL(topo)
Log Recorded by Pat Goodson
Comments:

G:Grab/SS:Split Spoon/ST:Shelby Tube

Project Bergstrom AFB IRP Phase II Stage 1
Beginning 2/20/85 and end 2/20/85 of drilling operation
Sampling Interval (Estimated) 2.5 (ft)
Drill Rig Mobile B-53
Drill Operator Jose Landeros

Depth (ft)	Sample Zone	Sample Type	Sample ID#	Lithologic Description	Remarks
+5					
0	I	ST	C-3(1)	CLAY; slight gravel, black, soft, moist.	
2.5	I	ST	C-3(2)	CLAY; slight gravel, mottled tan and black, soft, moist.	
5.0	I	ST	C-3(3)	CLAY; very slight gravel, black, soft, moist.	
7.5	I	ST	C-3(4)	CLAY; gravelly, black, stiff, moist, gravel (20-30%).	
10	I	ST	C-3(5)	CLAY; sandy and gravelly, light brown, loose moist. TD: 10 feet. Drager Hydrocarbon Test (positive, slight greenish tint. Low concentration). The Drager test was performed after total depth. Testing was done through the surface opening on the hollow stem auger.	Abandonment of the boring was through backfilling of cuttings.

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CORPORATION

Boring Completion Log: Sheet 1 of 1

Boring or Well No. CH-9
Project Bergstrom AFB IRP 212-027-11
Location Site 9
Log Recorded by Peter A. Waterreus

Construction

Construction Started 2/20/85
Completed 2/20/85
Total Depth Drilled (ft) 10.0
Hole Diameter 8-inch
Drilling Method Free flight hollow-stem auger (Mobile B-53 rig)
Problems encountered during drilling/completion None

Water source for drilling and completion procedures Bergstrom AFB potable supply

Sampling

Number, type and disposition of samples collected 5 Shelby tube

Sample interval (ft-ft) 0.0-1.0, 2.5-3.5, 5.0-6.0, 7.5-8.5, 10.0-11.0

Storage and/or preservation method(s) Clear glass quart jar and lid

Materials

Casing type N/A
Diameter N/A
Top of well casing (ft-AGL/BGL) N/A
Elevation (ft-msl) N/A
Depth of casing (ft) N/A
Screen type N/A
Diameter N/A
Slot size N/A
Screen interval (ft-ft) N/A

Type(s) of glue used to join casing N/A
Type of gravel/sand pack used N/A
Amount of gravel pack used N/A
Grain size distribution of gravel pack N/A
Lithology of gravel pack N/A
Source (company and quarry/pit) N/A

Interval of gravel pack (ft-ft) N/A
Interval of bentonite seal (ft-ft) N/A
Interval of grouting (ft-ft) N/A

Comments

Backfilled with cuttings

Description of Security Measures

N/A

Padlock ID No. N/A
Location of key(s) N/A

RADIAN CORPORATION

Drilling Log

Boring or Well No. CH-10
Sheet 1 of 1

Location Low Point Drain by Bldg. 4544
x Ground Level Elev.: ^ 490 ft.MSL(topo)
Log Recorded by Pat Goodson
Comments:

G:Grab/SS:Split Spoon/ST:Shelby Tube

Project Bergstrom AFB IRP Phase II Stage 1
Beginning 2/2/185 and end 2/21/85 of drilling operation
Sampling Interval (Estimated) 2.5 (ft)
Drill Rig Mobile B-53
Drill Operator Jose Landeros

Depth (ft)	Sample Zone	Sample Type	Sample ID#	Lithologic Description	Remarks
+5					
0	I	ST	C-4(1)	CLAY; gravelly, black, soft, moist, tan gravel (20-30%).	
2.5	I	ST	C-4(2)	CLAY; same as above.	
5.0	I	ST	C-4(3)	SAND AND CLAY; tan, loose.	
7.5	I	ST	C-4(4)	CLAY; black, soft, moist.	
10	I	ST	C-4(5)	CLAY; tan and black, soft, moist, some minor gravel. TD: 10 feet. Drager Hydrocarbon Test (Negative). The Drager test was performed after total depth. Testing was done through the surface opening on the hollow stem auger.	Abandonment of the boring was through backfilling of cuttings.

RADIAN CORPORATION

Boring Completion Log: Sheet 1 of 1

Boring or Well No. CH-10

Project Bergstrom AFB IRP 212-027-11

Location Site 9

Log Recorded by Peter A. Waterreus

Construction

Construction Started 2/21/85 Completed 2/21/85

Total Depth Drilled (ft) 10.0 Hole Diameter 8-inch

Drilling Method Free flight hollow-stem auger (Mobile B-53 rig)

Problems encountered during drilling/completion None

Water source for drilling and completion procedures Bergstrom AFB potable supply

Sampling

Number, type and disposition of samples collected 5 Shelby tube

Sample interval (ft-ft) 0.0-1.0, 2.5-3.5, 5.0-6.0, 7.5-8.5, 10.0-11.0

Storage and/or preservation method(s) Clear glass quart jar and lid

Materials

Casing type N/A Diameter N/A

Top of well casing (ft-AGL/BGL) N/A Elevation (ft-msl) N/A

Depth of casing (ft) N/A

Screen type N/A Diameter N/A

Slot size N/A Screen interval (ft-ft) N/A

Type(s) of glue used to join casing N/A

Type of gravel/sand pack used N/A

Amount of gravel pack used N/A

Grain size distribution of gravel pack N/A

Lithology of gravel pack N/A

Source (company and quarry/pit) N/A

Interval of gravel pack (ft-ft) N/A

Interval of bentonite seal (ft-ft) N/A

Interval of grouting (ft-ft) N/A

Comments

Backfilled the hole with cuttings.

Description of Security Measures

N/A

Padlock ID No. N/A Location of key(s) N/A

RADIAN
CORPORATION

APPENDIX E

RAW FIELD DATA

WELL DEVELOPMENT

Each of the six monitor wells were developed using a 1/3 h.p., single phase, 230 volt Franklin motor with a Goulds pump connected to a 1-1/4 inch flexible black poly-hose.

Each well was surged numerous times by lifting the pump intake to either the top of the screen or top of the water, if within the screen, and repeatedly turning the pump on and off. This was done at 3 points within the screen, then the pump was raised and lowered the length of the screen before being placed on bottom to remove any resulting silt. This surging process was repeated until the water condition was clear and approved by the on-site Radian representative.

WELL DEVELOPMENT - MONITOR WELL NO. 1

Screen: 21.4' to 31.4' bgl
Top of Sand: 18.6' bgl

March 28, 1984
WL TOC 0910 hours 22.87'
WL TOC with pump in well 19.99'

Time	Pump	Result
0925 hrs.	pump on	water very silty
0930 hrs.	10 gpm	water very silty
1000 hrs.	10 gpm	water moderately silty
1025 hrs.	8 gpm	water clear, rate cut back to stabilize WL
1030 hrs.	8 gpm	began surging well screen, surged 4 times, becomes very silty
1100 hrs.	8 gpm	water clear
1115 hrs.	8 gpm	surged screen 2 times, moderate increase in silt
1130 hrs.	8 gpm	water clear, surged well 3 times, water remains clear
1140 hrs.	8 gpm	shut-off pump

Total volume pumped 1,160 gallons
Maximum drawdown 22.96' TOC

WELL DEVELOPMENT - MONITOR WELL NO. 2

Screen: 19.6' to 30.0' bgl
Top of Sand: 16.8' bgl

March 29, 1984
WL TOC 0950 hours 20.08'
WL TOC with pump in well 19.23'

Time	Pump	Result
1000 hrs.	pump on	water very silty
1015 hrs.	6 gpm	water moderately silty
1030 hrs.	6 gpm	water clear, surged screen 2 times water becomes very silty
1146 hrs.	7.5 gpm	water clear, surge 5 times, water becomes moderately silty
1210 hrs.	7.5 gpm	water clear, surge 4 times, water remains clear
1225 hrs.	9 gpm	water clear, rate change without valve adjustment
1250 hrs.	9 gpm	water clear, surged well 2 times, no silt developed
1256 hrs.	9 gpm	shut-off pump

Total volume pumped 1,327 gallons
Maximum drawdown 23.92' TOC

WELL DEVELOPMENT - MONITOR WELL NO. 3

Screen: 16.0' to 26.0' bgl
Top of Sand: 14.0' bgl

March 28, 1984
WL TOC 1210 hours 19.75'
WL TOC with pump in hole 13.84'

Time	Pump	Results
1220 hrs.	began pumping	water very silty
1225 hrs.	1 gpm	water very silty
1455 hrs.	1 gpm	water clear
1500 hrs.	1 gpm	surged screen 5 times, water becomes moderately silty
1530 hrs.	2 gpm	increased rate
1536 hrs.	4 gpm	increased rate
1800 hrs.	4 gpm	surged well 5 times, water remains clear
1924 hrs.	4 gpm	shut-off pump

Total volume pumped 1,139 gallons
Maximum drawdown 20.15' TOC

WELL DEVELOPMENT - MONITOR WELL NO. 4

Screen: 19.6' to 29.6' bgl
Top of Sand: 15.6' bgl

April 3, 1984
WL TOC 21.33'
WL TOC with pump in well 19.67'

Time	Pump	Result
0940 hrs.	pump on	very silty
0950 hrs.	0.5 gpm	very silty
1000 hrs.	pumped off	
1020 hrs.	10 gpm for 20 sec.	very silty
1040 hrs.	10 gpm for 20 sec.	very silty
1110 hrs.	10 gpm for 20 sec.	very silty
1130 hrs.	10 gpm for 20 sec.	moderately silty
1150 hrs.	10 gpm for 20 sec.	moderately silty
1320 hrs.	10 gpm for 30 sec.	moderately silty
1350 hrs.	10 gpm for 20 sec.	slightly silty
1400 hrs.	10 gpm for 20 sec.	nearly clear
1410 hrs.	10 gpm for 20 sec.	nearly clear

Total volume pumped 39 gallons
Maximum drawdown dry

WELL DEVELOPMENT - MONITOR WELL NO. 5

Screen: 29.9' to 40.0' bgl
Top of Sand: 23.8' bgl

March 29, 1984

WL TOC 27.37'
Bailed 62 liters (16.4 gallons)
Water was very silty in beginning, but cleared up with last 8 bails

April 2, 1984

WL TOC 27.31'
WL TOC with pump in well 25.56'

Time	Pump	Results
1500 hrs.	pump on	moderately silty
1510 hrs.	0.5 gpm	moderately silty
1600 hrs.	0.5 gpm	pumped off
1610 hrs.	10 gpm for 30 sec.	moderately silty
1620 hrs.	10 gpm for 25 sec.	moderately silty
1625 hrs.	10 gpm for 20 sec.	moderately silty
1710 hrs.	10 gpm for 30 sec.	moderately silty
1720 hrs.	10 gpm for 20 sec.	slightly silty
1730 hrs.	10 gpm for 20 sec.	slightly silty
1750 hrs.	10 gpm for 20 sec.	very slightly silty
1845 hrs.	10 gpm for 30 sec.	very slightly silty

Total volume pumped 61.2 gallons
Maximum drawdown dry

April 3, 1984

Unknown volume bailed by Radian Personnel

WELL DEVELOPMENT - MONITOR WELL NO. 6

Screen: 15.0' to 25.0' bgl
Top of Sand: 14.0' bgl

April 2, 1984
WL TOC 21.82
WL TOC with pump in well 19.99'

Time	Pump	Result
0900 hrs.	pump on	water very silty
0905 hrs.	3.5 gpm	water very silty
0915 hrs.	3.5 gpm	water slightly silty
0937 hrs.	3.5 gpm	water very slight silty
0950 hrs.	3.5 gpm	surge screen 3 times, water becomes very silty
1145 hrs.	3.5 gpm	water very slightly silty, surge 4 times, water becomes very silty
1400 hrs.	3.5 gpm	clear, surge 4 times, no silt
1430 hrs.	3.5 gpm	water clear, pump shut-off

Total volume pumped 1,155 gallons
Maximum drawdown 22.20' TOC

Project No. 212-~~027~~-11

TITLE BERGSTROM AFB IRP STAGE I · Book No. 2

From Page No.

MONITOR WELL No. 1

4/11/84 GW SAMPLING AT ~~M~~-Well #1

— First Round —

1144 SWL = 23.01 BMP { "0" = 35 - 3.70' = 31.30
55 - 0.69 cut

Standardized pH meter + conductivity meter

Cond. @ 21°C 650 (STND), 645 meter
pH " 7.0 " , 7.02 "

— FIELD GW MEASUREMENTS —

Date/Time		Temp °C	pH	Cond umhos	Q (GPM)	Remarks
4/11/84 1220	pump on					Set to just below total submergence
1225	"	21	7.33	400		Murky, tan (1 gal in 1 Min 05 sec)
1230	"	20.5	7.33	470	1	murky, Tan, silty
1235	"	20.5	7.34	510	1	Murky, tan,
1240	"	20.5	7.33	520	1	Murky a little clearing
1245	"	20.5	7.23	515	1	Murky clearing
1300	"	20.5	7.24	540	1	slightly murky
1305		20.5	7.20	520	1.2	Almost clear
1310	"	20.5	7.38	530	1.2	Almost clear slightly murky
1315	"	-	-	-	-	Begin sample collection
1319	Pump off	-	-	-	-	End of sample collection

1340 Decontaminated pump
Outside w/ mild soap + potable water followed by distilled rinse water
inside w/ 3 gal " " " " " " 3 gal "

To Page No. 14

Witnessed & Understood by me.	Date	Invented by	Date
		Recorded by RAB/EWP	4/11/84

Project No. 212-027-011
Book No. 2 TITLE BERGSTROM AFB IRP STAGE I

From Page No. 13

1350 Finish cleaning pump, prepare to move to monitor #2

MONITOR WELL No. 2

1421 AT ~~M-Well~~ #2 ; begin setting up. — FIRST ROUND —

1426 SWL: 21.09 ft BMP { "0" = 31.30 ; 50 + 2.39 cut }

Date/Time 4/11/84	Temp (°C)	pH	Cond umho/cm	Q (GPM)	Remarks
1437 Pump on					
1442	21.5	7.25	635	1	cloudy
1445	21.0	7.17	615	1	slight cloudy, some silt
1452	21.0	7.35	610	>1	slight, cloudy
1457	21.0	7.22	600	1.1	slightly cloudy, clarity improving
1502	21.0	7.18	605	1.1	Almost clear, can now see thermo/probe thru it
1507	21.0	7.07	610	1.1	Almost clear, can see thermo probe thru it.
1512	21.0	7.16	590	1.1	same
1520	21.0	7.17	615	1.1	same
1534 Begin sample collection					
1537 Pump off					

To Page No. 15

Witnessed & Understood by me	Date	Invented by	Date
		Recorded by TRAB	4/11/84

From Page No. 14

1540 Begin decontamination of pumps.
1555 End " " " prep to break down equipment & take samples to lab.

1602 Heading for Lab

MONITOR WELL No. 5

—First Round—

4/12/84

0818 Setting up at ~~M-Well #5~~ to purge well then let recover before sampling taken today. Will collect water samples as well pumps to check parameters. Will set pump to just below SWL & lower as level drops.

0823 SWL: 27.42 BMP { "0" = 31.30 ; 60 - 1.28 }

pH meter: 7.0 Standard ; 7.04 meter @ 21°C
650 Stnd ; 590 meter @ 21°C

4/12/84

Time		Temp (°C)	pH	Cond (umhos/cm)	Q (GPM)	
0840	Pump on					
0843		21.5	6.50	1550	~0.5	Air getting low, Clear
0846		21.5	6.44	1650	—	Lowered pump, setting air; Clear
0850		21.5	6.42	1640	~0.5	slightly cloudy
0852		21.5	6.40	1620	~1	> air pressure slightly cldy
0855		21.5	6.47	1950	~1	murky, w/suspended clay
0858		22.0	6.47	1870		murky
0901		22.0	6.49	~~2010~~ 2100		noticeably more murky
0904	pump off	22.0	6.54	2300		

continue on To Page No.

Pump on & get more H_2O & test rate in hour

Witnessed & Understood by me. | Date | Invented by | Date

Recorded by RAB

4/12/84
0842 Completed decontamination of MW-5 & check out of supplies, prepare to move to MW-4

MONITOR WELL No. 4

1005 MW-4 SWL = 21.33 BMP { "0" = 31.30 55 - 2.37 } -First Round-

Will Bail MW-4 to prep for sampling

4/12/84
~1010

Cumulative Bails (~1 qrt/bail)	Temp	pH	Cond.	Remarks
4	23.0	6.69	1220	Almost clear
8	23.0	6.61	1320	" "
12	23.0	6.64	1060	cloudy some sediment
16	23.0	6.60	1140	cloudy, more sediment
20	23.0	6.54	1590	murky, more sediment
24	24.0	6.62	1080	" " & silty
28	24.0	6.61	1100	" noticeably silty; some brown bailings
32	24.5	6.66	1200	" lots of silt.

1033 End of bailing.
1057 Final purge at MW-4 will now prep for MW-3.

1115 Called Steve Gibson and he said no VOA vials for my samples are needed.

To Page No. 16

Witnessed & Understood by me,	Date	Invented by	Date
		Recorded by RAB	4/12/84

Project No. 212-027-11

TITLE BERGSTROM AFB IRP STAGE I Book No. 2

From Page No. 16

MONITOR WELL No. 3

MW #3

1135 SWL: 19.48 BMP { '0" = 31.30 { 50 + 0.78 - First Round -

4/12/86

	Temp.	pH	Cond	Q	REMARKS
1145 pump on				1½	
1150	23.0	7.12	590	1.2	cloudy
1155	23.0	6.93	605	1.2	Cloudy
1200	23.0	6.89	615	1.2	cloudy but clearing
1205	22.0	6.86	620	1.2	slightly cloudy, almost clear
1210					Begin to sample.
1212 Pump off					End of sample

1249 Finished cleaning pump now to go to well #6

MONITOR WELL No. 6

MW #6

1307 SWL = 21.92 { '0" = 31.30 { 55 - 1.78 - First Round -

	Temp	pH	Cond	Q	REMARKS
1320 pump on					
1322	24.0	7.20	710	1.2	very murky, silty
1324	24.0	6.86	655	—	" "
1326	23.0	6.82	650		Murky, "
1328	23.0	6.83	700	1.2	Murky but clearing
1332	23.0	6.75	690	—	clearing.
1336	23.0	6.73	695	1.2	"
1340	23.0	6.72	680	—	

1342 Begin to sample
1344 End sample
1345 Pump off

To Page No. 18

Witnessed & Understood by me, Date

Invented by

Recorded by RAB

Date 4/12/86

TITLE BERGSTROM AFB IRP STAGE I Project No. 212-027-11 Book No. 2 1

From Page No.

—First Round—

A070 A Groundwater, brn glass w/ H_2SO_4 (MW-4)

A070 B ", " " no preser.

A070 C ", plastic w/ HNO_3

A070 D ", Clear glass 1 liter

A070 E ", 1 qt clear glass

1440 AT MWell #5 rdy to take sample with Kemmerer bottle. 1st sample to spoil

1504 Finish Kemerrer catches

1527 Finished at MWell #5 prep to MW-4

1554 Setting up a MW-4

1637 End of activities at MW-4 cleaned Kemerer bottle like before mild soapy water (distilled) followed by distilled rinses

—First Round—

GOLF COURSE WELL

Golf course well could not be sampled as inoperative.

—First Round—

END SAMPLING

To Page No.

Witnessed & Understood by me.	Date	Invented by	Date
		Recorded by	

Project No. 212-027-11

TITLE BERGSTROM AFB IRP STAGE I Book No. 2

From Page No. —

May 10, 1984 Monitor Well Sampling – 2nd Round.

MONITOR WELL No. 1

08:00 – Monitor Well #1 – DTW 23.26 ft MP.

08:40 – Begin Pumping w/ Bladder Pump @ 1 gpm
08:45 – Pump Bladder Problem – pull pump.
09:00 – Pump Repaired – Resume Pumping @ 1 gpm

T = 21°C pH = 7.00 Cond. = 450 mmhos

09:10 – Pumping @ ~ 1 gpm

T = 21°C pH = ~~7.00~~ 6.95 Cond = 450 μmhos

09:22 – Pumping @ ~1 gpm T 21.5°C pH = 6.93 Cond – 450 μmhos
09:30 – Sampled Well from pump discharge

A074-A Brown Bottle – sulfuric acid to ≤ 2 pH
A074-B Brown Bottle – no preservative
A074-C Plastic Bottle – Nitric acid to ≤ 2 pH
A074-D Clear Bottle – no preservative
A074-E Widemouth Jar – no preservative.

Pump off @ 09:35
→ Total Pumped prior to sample ~ 30 gallons
→ Total Pumped ~ 40 gallons

Golf Course Well GOLF COURSE WELL

10:15 – DTW – 39.45 ft – T.O.C. (TOC ~ .5 ft above LS)
10:23 – Pump on @ ~ 25-30 gpm – SEcond Round

10:33 – T = 24°C ~~pH = 7.20~~ Cond. = 600 μmhos

10:38 – T = 22.5°C pH = 7.20 Cond = 600 μmhos

To Page No. 22

Witnessed & Understood by me.	Date	Invented by	Date
		Recorded by EWP	5/10/84

E-15

Project No. 212-027-11
Book No. 2 TITLE BERGSTROM AFB STAGE I

From Page No. 21

GOLF COURSE WELL CONT'd

5/10/84 — Second Round —

10:41 T = 22.8°C pH = 7.0 Cond = 600 µmhos

10:45 Sampled Well

A075 A = Brown Bottle - H_2SO_4 ≤ 2 pH
A075 B - Brown Bottle - no preservative
A075 C - ~~Glass Clear~~ Plastic - HNO_3 ≤ 2 pH
A075 D - Glass Clear - no preservative
A075 E - Wide Mouth Glass - " "

10:46 Pump off.

Total Pumped before sampling 750 - 900 gallons
Total Pumped 780 - 930 gallons

MONITOR WELL No. 2

11:00 Monitor Well 2
DTW = 21.36 M.P. — Second Round —

11:06 Begin Pumping @ .85 gpm

11:03 T = 22.0°C pH = 7.30 Cond = 550 µmhos

11:17 Pumping @ ~ 1 GPM
T = 21.2°C pH = 7.40 Cond = 520 µmhos

11:25 Pumping @ ~ 1 GPM
T = 21.0°C pH = 7.5 Cond = 510 µmhos

11:30 Sampled MW-2

A076 - A Brown Bottle H_2SO_4 ≤ 2 pH
A076 - B Brown Bottle no preservative
A076 - C Plastic Bottle HNO_3 ≤ 2 pH
A076 - D Glass Bottle no preservative
A076 - E Wide Mouth Jar " "

To Page No 23

Witnessed & Understood by me | Date | Invented by | Date 5/10/84
Recorded by EWP

Project No. 212-027-11

TITLE BERGSTROM AFB STAGE 1 IRP   Book No. 2

From Page No. 22

MW-2 CONT'd

5/10/84

11:32 Pump off

Total Pumped before sample ~ 22.5 gallons

Total Pumped ~ 25 gallons

MONITOR WELL NO. 3

11:55 Monitor Well 3

DTW = 19.74' M.P. -Second Round-

12:04 Begin Pumping @ ~ .9 GPM (Murky)

T: ~~23.5°C~~ 22.0°C pH = ~~3.5~~ 7.4 Cond. = ~~600~~ 550 umhos

12:12 Pumping @ 1.1 GPM

T = 21.5°C pH = 7.5 Cond = 550 umho

12:20 Pumping @ 1.1 GPM (clearer)

T: 21.2°C pH = 7.6 Cond. = 540 umhos

12:30 Sampled Well MW-3

A077A Brown Bottle - H_2SO_4 ≤ 2 pH

A077B Brown Bottle - no preservative

A077C Plastic Bottle - HNO_3 ≤ 2 pH

A077D Glass Bottle - no preservative

A077E Wide Mouth Jar - " "

12:33 Pump off.

<Continued on Page 40>

To Page No. 40

Witnessed & Understood by me	Date	Invented by	Date
		Recorded by EWP	5/10/84

Project No. 212-027-11
Book No. 2 TITLE BERGSTROM AFB IRP STAGE I

From Page No. 23

SECOND ROUND

Continued from Page 23

5/10/84

MONITOR WELL No. 5

14:08 Monitor Well #5
DTW = 27.78 ft. MP.

14:15 Begin Bailing.

14:50 Well dewatered to T.D.
Bailed 15 gallons of fluid.

Simultaneous with above. MONITOR WELL No. 4

14:25 Monitor Well 4

DTW = 21.36 ft MP.

Bailed Approx 10 gallons.

MONITOR WELL No. 6

15:08 Monitor Well 6

DTW = 22.16 MP.

15:15 Begin Pumping @ ≈ .8 GPM

T = 26.5°C pH = 7.5 Cond. = 690 μmhos

15:25 Pumping @ ≈ .9 GPM

T = 24°C PH = 7.4 Cond. 680 μmhos

15:30 Sampled Well
A078 A - Brown Bottle - H_2SO_4 ≤ 2 pH
A078 B - Brown Bottle - No Preservative
A078 C - Plastic Bottle - HNO_3 ≤ 2 pH
A078 D - Glass Bottle - No Preservative
A078 E - Wide Mouth Jar - " "

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Witnessed & Understood by me	Date	Invented by	Date
		Recorded by EWD	5/10/84

Project No. 212-02-11

TITLE Bergstrom IRP STAGE I Book No. 2 1

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SECOND ROUND

15:32 Stop Pumping.

MONITOR WELL No. 4 cont'd.

11 MAY 84

0805 AT MW-4 prep. to sample groundwater with Kemmerer bottle.

0840 SAMPLE well #4
A079A - Brown bottle - H_2SO_4 ≤ 2 pH
A079B - Brown bottle - No preservation
A079C - Plastic bottle - HNO_3 ≤ pH
A079D - Glass bottle - No preservation
A079E - Wide mouth jar - No preservation

0900 Finished sampling took sample for
Temp : 21 °C
pH : 6.7
Cond : 780

MONITOR WELL No. 5 cont'd

0940 AT MW-5 prep to sample.

1005 Completed sampling at MW-5

A080A - Brown bottle - H_2SO_4 ≤ 2 pH
A080B - " " - No preservation
A080C - Plastic bottle - HNO_3 ≤ 2 pH
A080D - Glass bottle - No preservation
A080E - Wide mouth jar - No preservation

1008 MW-4 pH - 6.5
Temp - 24.5 °C
Cond - 1500

END SAMPLING

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Witnessed & Understood by me	Date	Invented by	Date
		Recorded by EWP	5/11/84

Project No. 212-027-11

48 Book No. 2 TITLE BERGSTROM AFB IRP STAGE I

From Page No.

2/25/85 JP-4 Pipeline Leak (suspected) - one round of sampling required. MW-7 dry took air sample at HS-2

9:50 AW + RAB to site 9 Bergstrom

10:15 Took air sample. Drager Positive Hydrocarbons (1 pump)
no water until the tip of the probe was wet
depth of top of casing (0.18' below ground)

10:30 MW-~~2~~8 depth of casing 0.48 below top of Box 0.5 BGL

10:35 water level 30' - 1.96' = 28.04' (Drager NEG - 15 pumps)

10:50 MW-~~3~~9 depth of casing 0.51 below Box 0.50 BGL
water level 30' + 0.34' = 30.34'
Drager (NEG 15 pumps)

11:00 dropped off RAB + AW went to lunch

MONITOR WELL No. 8

11:45 back from lunch at ~~MW-2~~8 for sampling

Temp	pH	Cond		
22°C	>12	700	11:03	water clear
22°C	10.8	710	11:03	water silty

12:00 MW-~~3~~9 start bailing

MONITOR WELL NO. 9

	temp	pH	Cond		
5	21	>12	720	12:10	silty
10	21	>12	780		silty
15	22	>12	790		silty
20	23	>12	790	12:25	silty

12:30 collected sample from MW-~~3~~9

23	>12	790	0.104	silty

≈ 1/3 vol in silt 2/3 fluid

NOTE The pH meter is broken since I placed a pH 4 buffer solution in it and it showed pH >12

12:50 HS-3 Time 12:57 of sample

1:15 HS-4 Drager neg (15 pumps)

1:30 at HS-1 Drager neg (15 pumps)

1:45 finished going back to Radian

* Also another original TRAB

To Page No.

Witnessed & Understood by me | Date | Invented by | Date

Recorded by

E-20

Form.8

IRP FIELD WATER SAMPLING FORM

RADIAN CORPORATION
(DISCLAIMER: Data entered on this form was obtained during field sampling. All entries are preliminary in nature, do not represent Radian's final assessment and maybe subject to revision at any time.)
Sampler PAW/TKW

SAMP.POINT: MW-2
LOCATION: BAFB
PROJECT: Bergstrom AFB 212-027-11
CONTRACT: F33615-83-D-4001, 011
Sheet 1 of 1

Date/time	Discharge (GPM/Bail(s)) Note SWL start/ End.(1)	Field Measurements Temp. (2)	Conductivity. (3)	pH	Remarks (Note bailer capacity)
RESAMPLE FOR PESTICIDES					
9/4/85					
1:30	SWL 20.95'	TD 32.9'			
1:56	3 bails	25°C	630	6.8	
	3 "	25°C	620	6.5	
	3 "	26°C	618	6.8	
	3 "	22°C	625	6.8	
	3"	21.5°	640	6.8	
	3"	22°C	620	6.8	
	Got sample: AVO				

Note: (1) Depth measurements made by Steel Tape (ST); Rope & Bailer (R/B) and Electric Line (EL).
(2) Temperature in degrees celsius.
(3) Conductivity in micromhos/centimeter at field temperature.

Form.8

IRP FIELD WATER SAMPLING FORM

RADIAN CORPORATION
(DISCLAIMER: Data entered on this form was obtained during field sampling. All entries are preliminary in nature, do not represent Radian's final assessment and maybe subject to revision at any time.)

SAMP.POINT: MW-3
LOCATION: BAFB

PROJECT: Bergstrom AFB
212-027-11
CONTRACT: F33615-83-D-4001, 011

Sampler MW/TKW

Sheet 1 of 1

Date/time	Discharge (GPM/Bail(s)) Note SWL start/ End. (1)	Field Measurements Temp. (2)	Conductivity. (3)	pH	Remarks (Note bailer capacity)
	RESAMPLE FOR PESTICIDES				
9/4/85 2:00	SWL 19.49'	TD 29'			
	3 bails	28°C	580	6.6	
		24°C	600	6.4	
		23°C	580	6.4	
		22°C	620	6.6	
		21.5°C	600	6.6	
		21.0°C	610	6.6	
	GET SAMPLE &	A111			

Note: (1) Depth measurements made by Steel Tape (ST): Rope & Bailer (R/B) and Electric Line (EL).
(2) Temperature in degrees celsius.
(3) Conductivity in micromhos/centimeter at field temperature.

Form.8

IRP FIELD WATER SAMPLING FORM

RADIAN CORPORATION
(DISCLAIMER: Data entered on this form was obtained during field sampling. All entries are preliminary in nature, do not represent Radian's final assessment and maybe subject to revision at any time.)

SAMP.POINT: MW-4
LOCATION: BIRP LANDFILL #7
PROJECT: Bergstrom AFB 212-027-11
CONTRACT: F33615-83-D-4001, 011

Sampler BAW / TKW

Sheet 1 of 1

Date/time	Discharge (GPM/Bail(s)) Note SWL start/ End.(1)	Field Measurements Temp. (2)	Conductivity. (3)	pH	Remarks (Note bailer capacity)
	RESAMPLE FOR PESTICIDES				
11:30	SWL 21.34' begin	Baily			
	3	25°C	850	6.6	
	6	24°C	3100	6.4	
	8.5	24°C	3250	6.4	
	9 → Bailed Dry				
11:50					
3:05	GET SAMPLE:	A114			

Note: (1) Depth measurements made by Steel Tape (ST); Rope & Bailer (R/B) and Electric Line (EL).
(2) Temperature in degrees celsius.
(3) Conductivity in micromhos/centimeter at field temperature.

Form.8

IRP FIELD WATER SAMPLING FORM

RADIAN CORPORATION
(DISCLAIMER: Data entered on this form was obtained during field sampling. All entries are preliminary in nature, do not represent Radian's final assessment and maybe subject to revision at any time.)

SAMP.POINT: MW-5
LOCATION: BIRP
LANDFILL 6
PROJECT: Bergstrom AFB
212-027-11
CONTRACT: F33615-83-D-4001, 011

Sampler PAW / TKW

Sheet 1 of 1

RESAMPLE FOR PESTICIDES

Date/time	Discharge (GPM/Bail(s)) Note SWL start/ End. (1)	Field Measurements Temp. (2)	Conductivity. (3)	pH	Remarks (Note bailer capacity)
12:00	SWL 27.4'				
	Pump				
		28°C	3800	6.25	
		26°C	3800	6.4	
12:50	SWL 30.0'				
	going to Bail	26°C	3750	6.2	
	2				
	5	25°C	3750	6.2	
	8	24°C	3850	6.3	
	11	24°C	2150	6.4	
	Bailed Dry				
2:50	Get sample A113				

Note: (1) Depth measurements made by Steel Tape (ST); Rope & Bailer (R/B) and Electric Line (EL).
(2) Temperature in degrees celsius.
(3) Conductivity in micromhos/centimeter at field temperature.

Form.8

IRP FIELD WATER SAMPLING FORM

RADIAN CORPORATION
(DISCLAIMER: Data entered on this form was obtained during field sampling. All entries are preliminary in nature, do not represent Radian's final assessment and maybe subject to revision at any time.)

Sampler PRW/TKW

SAMP.POINT: MW-6
LOCATION: BAFB

PROJECT: Bergstrom AFB
212-027-11
CONTRACT: F33615-83-D-4001, 011

Sheet 1 of 1

Date/time	Discharge (GPM/Bail(s)) Note SWL start/ End.(1)	Field Measurements Temp. (2)	Conductivity. (3)	pH	Remarks (Note bailer capacity)
	RESAMPLE FOR PESTICIDES				
2:25	SWL 21.89'	TD	28.37		
	3 bails	26°C	820	6.2	
	3	24°C	880	6.2	
	3	24°C	920	6.2	
	3	24°C	920	6.0	
2:36	3	23.5°	920	6.0	
2:40	GET SAMPLE:	A112			

Note: (1) Depth measurements made by Steel Tape (ST); Rope & Bailer (R/B) and Electric Line (EL).
(2) Temperature in degrees celsius.
(3) Conductivity in micromhos/centimeter at field temperature.

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APPENDIX F

SAMPLING AND ANALYTICAL PROCEDURES

BERGSTROM AFB IRP PHASE II STAGE 1

FIELD INVESTIGATION SAMPLING

QUALITY CONTROL PLAN

Prepared by:

Radian Corporation
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Austin, Texas 78766

1.0 INTRODUCTION

Field investigations under the US Air Force Installation Restoration Program generate a large number of soil, waste and/or water samples for chemical analysis. The analytical results are then used to interpret the impact of a waste site upon the local hydrogeologic system(s). Since each analysis forms a foundation for interpretation, it is important that each sample is representative of a particular situation.

A quality control (QC) plan provides a guideline through which field samples can be obtained, preserved and controlled. This will ensure that the integrity of the sample is maintained and that no contamination or cross contamination will occur.

The remainder of this QC plan describes the general collection of soil, waste and water samples. Methods of preservation, shipping and administrative controls are also discussed.

2.0 QUALITY CONTROL PROCEDURES FOR SOIL AND WASTE SAMPLING AND ANALYSIS

Based upon the sampling scheme as discussed in the Statement of Work, soil and possibly waste samples will be collected from the following areas:

- South Fork Drainage Ditch
- MOGAS Spill at Motor Pool
- Fire Training Area
- Combined Southeast Landfill
- JP-4 Spill/Overtopped Tank Area
- JP-4 Suspected Underground Line Leak

Analytical parameters for the soil samples are summarized in Table 2-1. Field collection procedures are described in Table 2-2. Quality control procedures for sample collection and analysis are discussed below.

2.1 Collection of Soil Samples

Quality control procedures associated with soil sampling will be an integral part of the sampling methodology. These procedures focus upon ensuring the collection of representative samples which are free from external contamination. Documentation and chain-of-custody procedures are also an important part of the sample collection QC effort, which include the following procedures:

- Split-spoon and hand auger sampling will be used to obtain representative samples from depth specific points, as opposed to sample cuttings which may originate at different points and be cross-contaminated.

TABLE 2-1.

Levels of Detection are for water unless shown otherwise:

	Levels of Detection Required
VOC	*
** TOC	1 mg/L
** TOX	5 ug/L (waters); 5 ug/g (soil)
Oil & Grease (IR)	0.1 mg/L (waters); 100 ug/g (soil)
Polychlorinated Biphenyls	0.25 ug/L (waters; 1 ug/g (soil)
Phenols	1 ug/L (waters); 1 ug/g (soil)
Arsenic	10 ug/L
Barium	200 ug/L
Cadmium	10 ug/L
Chromium	50 ug/L (waters); 5 ug/g (soil)
Copper	50 ug/l
Lead	20 ug/L (waters); 2 ug/g (soil)
Mercury	1 ug/L
Nickel	100 ug/L
Selenium	10 ug/L
Silver	10 ug/L

	Pestioide Analyses (ug/L)
DDT isomer	0.02
Dibrom	0.03
2,4-D	0.06
2,4,5-TP silvex	0.06

For soils, use detection levels shown above, but report values as micrograms pesticide per gram of soil.

* As specified in U. S. EPA Methods 601 and 602.

** Detection levels for TOC and TOX must be 3 times the noise level of the instrument. Laboratory distilled water must show no response. If so, corrections of positive results must be made.

TABLE 2-2. FIELD COLLECTION OF SAMPLES

Following guidance is provided field survey personnel to assist them in collecting, preparing and preserving samples.

Soil Sample Collection

Soil samples will be placed in containers as described below:

Analysis Required	Field Procedure
Oil and Grease, Lead, Nickel, Chromium, Cadmium and Copper	Prepare a homogeneous soil mixture and fill a 1-quart glass jar with Teflon liner. Note: One jar provides RAS with sufficient soil to perform any or all requested analyses. Keep samples chilled to 4°C.

Water Sample Collection

Analysis Required	Field Procedure
TOC and/or phenol	Collect sufficient water and fill a 500 ml glass jar. Add 2 ml (1 plastic pipet full) of Sulfuric Acid. Keep samples chilled to 4°C.
Purgeable Halocarbons and Aromatics	Collect sufficient water and fill 2 each 40 ml VOA vials to the top (no air bubbles present). Cap and seal the vials. No air bubbles should be present. Keep samples chilled to 4°C.
TOX	Collect sufficient water and fill a 500 ml glass bottle to top (no air present). Keep samples chilled to 4°C.
Arsenic, Barium, Cadmium, Chromium, Copper, Lead, Mercury, Nickel, Selenium and Silver	Collect sufficient water and fill a 500 ml plastic bottle. Add 2 ml (1 plastic pipet full) of Nitric Acid. Keep samples chilled.

Oil and Grease	Collect sufficient water and fill a 1-quart glass bottle nearly to the top. Add 2 ml (1 plastic pipet full) of Sulfuric Acid. Keep samples chilled.
Pesticides/Polychlorinated Biphenyls	Collect sufficient water and fill a 1-liter glass bottle to the top. Cap with Teflon liner. Keep sample chilled to 4°C.

Air Sample Collection

Analysis Required	Field Procedure
Purgeable Hydrocarbons	Fill a stainless steel evacuated cylinder with ambient air from selected site.

- During the drilling, the on site geologist will ensure that cuttings coming to the surface on the auger flights are accurately described. This will serve as a general log to be confirmed by split-spoon samples.

- The split-spoon or hand auger sampler will be cleaned between each sampling to prevent cross-contamination of the samples in accordance with the safety plan.

- After sample collection, each sample will be logged into a master sample logbook (bound, paginated, laboratory notebook) which as a minimum indicates the date and time of sample collection, sample type, and initials of the person who collected the sample.

- Soil samples will be chilled for preservation until analyses.

- Chain-of-custody forms, Figure 2-1 will be used to document all Radian and USAF transfers of sample possession from initial preparation of the sample container to final disposition of the sample.

2.2 Analytical Quality Control for Soil Samples

In addition to the general sampling QC procedures described above, specific QC procedures and criteria are associated with various analyses and described below:

2.2.1 Metals

Heavy metals will be determined after acid extraction in accordance with EPA methods. Determination for these metals will involve both

inductively coupled plasma emission spectrometry (ICPES) and atomic absorption spectroscopy (AAS). The metals to be analyzed are presented in Table 2-1. Calibration and QC procedures for metals analyses are discussed below. These procedures are based upon EPA recommended procedures for the 200 Series Methods.

2.2.2 Calibration

Calibration curves will be generated daily for each metal species using a reagent blank and a minimum of three upscale concentrations. A calibration curve will be considered acceptable if the correlation coefficient, r, is $\geq$0.995. A new calibration curve will be generated after analysis of no more than 20 samples. the new curve will be acceptable if it meets the linearity criterion above, and if the slope agrees with that of the previous curve within $\pm$10%.

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FIGURE 2-1

CHAIN OF CUSTODY RECORD

Field Sample No. ____________

Company Sampled/Address ____________
Sample Point Description ____________

Stream Characteristics:
Temperature ____________ Flow ____________ pH ____________
Visual Observations/Comments ____________

____

Collector's Name ____________ Date/Time Sampled ____________
Amount of Sample Collected ____________
Sample Description ____________
Store at: ☐ Ambient ☐ 5°C ☐ −10°C ☐ Other ____________

☐ Caution · No more sample available ☐ Return unused portion of sample ☐ Discard unused portions

Other Instructions · Special Handling · Hazards ____________

____

____

☐ Hazardous sample (see below) ☐ Non-hazardous sample

☐ Toxic ☐ Skin irritant ☐ Flammable (FP< 40°C)
☐ Pyrophoric ☐ Lachrymator ☐ Shock sensitive
☐ Acidic ☐ Biological ☐ Carcinogenic · suspect
☐ Caustic ☐ Peroxide ☐ Radioactive
☐ Other ____________

Sample Allocation/Chain of Possession:
Organization Name ____________
Received By ____________ Date Received ____________ Time ____________
Transported By ____________ Lab Sample No. ____________
Comments ____________
Inclusive Dates of Possession ____________

Organization Name ____________
Received By ____________ Date Received ____________ Time ____________
Transported By ____________ Lab Sample No. ____________
Comments ____________
Inclusive Dates of Possession ____________

Organization Name ____________
Received By ____________ Date Received ____________ Time ____________
Transported By ____________ Lab Sample No. ____________
Comments ____________
Inclusive Dates of Possession ____________

3.0 QUALITY CONTROL PROCEDURES FOR GROUNDWATER SAMPLING AND ANALYSIS

Based upon the sampling scheme as discussed in the Statement of Work, ground-water samples will be collected from the following areas:

- Existing Wells
- MOGAS Spill at Motor Pool
- Fire Training Area
- Combined Southeast Landfill
- JP-4 Spill/Overtopped Tank Area
- JP-4 Suspected Underground Line Leak

Analytical parameters for the ground-water samples are summarized in Table 2-1. Field collection procedures are described in Table 2-2. Quality control procedures for sample collection and analysis are discussed below.

3.1 Sampling Quality Control for Groundwater Samples

Quality control efforts associated with groundwater sampling are primarily procedural quality control activities which are an integral part of the monitoring well development and sampling methodology. These procedures focus upon ensuring that the samples are representative of the specified depth and as free as possible from external and/or cross-contamination. Examples of the QC aspects of the groundwater sampling effort include the following:

- Groundwater levels will be measured and recorded before any groundwater disturbances.

- Initially, all wells will be pumped or bail-developed in order to remove all fines within the well and, to the extent possible, remove any drilling fluid, if used, which may have penetrated the formation during the drilling.

- All wells that are sampled will be evacuated with a clean PVC bailer or bladder pump until the pH and specific conductance of the groundwater stabilizes or until three well volumes of water have been displaced. In some cases the well may be bailed dry due to slow infiltration.

- Following evacuation, wells will be allowed to recover prior to sampling.

- Depth-discrete samples will be obtained utilizing a Kemmerer-type sampler constructed of inert materials to minimize the potential for sample contamination. If well conditions do not permit the use of a Kemmerer sampler then a Teflon bailer will be used.

- Samples must be transferred to sample jars with a minimum of agitation and disturbance in order to prevent stripping volatile organics from the water sample.

- All sampling equipment will be thoroughly cleaned prior to the start of work and between wells.

- Upgradient wells will be sampled first in order to minimize possible transfer of any contaminants among the wells.

- All samples will be chilled during transportation and storage.

3.2 Chain of Custody

Chain of custody documentation must accompany all samples. The chain of custody records will contain, at a minimum, the following information:

- Time, date, and location of sampling, and name of person performing sampling;
- Number, depth, and type of sample;
- Conditions encountered during well evacuation and water sample collection;
- The signature of the responsible on-site hydrogeologist, and the time and date he relinquished the samples to either the field laboratory technician or the transporter who will deliver samples to the analytical laboratory.

3.3 Analytical Quality Control for Groundwater Samples

In addition to the general QC procedures described above, specific QC procedures and criteria are associated with groundwater analyses. These are described below.

3.4 Purgeable Aromatics

Purgeable aromatics in the groundwater samples will be determined by a purged-cryotrap GC/PID method similar in some respects to EPA Method 602. Quality control procedures for this method are based on recommended procedures for Method 602 analyses.

3.5 Acceptability Tests

Section 8.2 of Method 602 describes the procedures for demonstrating ability to generate data of acceptable precision and accuracy. Briefly, this involves quadruplicate analyses of reagent water spiked with a "quality control check sample concentrate" and a "surrogate standard." Average percent recoveries and standard deviations are then calculated for each compound and compared to EPA values (Table 2, Method 602) to determine acceptability. These data should be available for inspection, but the acceptability test need not be repeated specifically for this project.

4.0 QUALITY CONTROL PROCEDURES FOR AIR SAMPLING AND ANALYSIS

Based upon the sampling scheme as discussed in the Statement of Work, air samples will be collected from:

- o JP-4 Suspected Underground Line Leak.

Analytical mehtods for air samples are described below. Field collection procedures are described below and in Table 2-2.

4.1 Canister Sampling

Ambient air samples are collected in evacuated stainless steel canisters. The canisters are 2.8 liter stainless steel spheres fabricated with stainless steel valves and fittings. The canisters are oven-baked, purged, and evacuated in the laboratory prior to sampling, and the absolute pressure is recorded. The canister vacuum provides the motive for vapor collection, avoiding the possible adverse effect of a pump on the sampling system. The sample is collected by connecting the canister to a sampling line and opening the valve. A sample of approximately 2 L (a canister volume = 2.8 liters) is collected, and the canister valve is closed.

After completion of the sampling, all canister valves are tightened and stem nuts sealed with Swagelock plugs and the canister is shipped to Austin.

4.2 Canister Analysis

When received by Radian personnel at Radian's Austin laboratory, each stainless steel canister will be assigned a code number and logged into a computerized master log. The final pressure will be read and recorded on the sample chain of custody form before pressurizing the canister with ultra high purity nitrogen (UHP N_2) to 10-15 psig. The final pressure is then measured

and recorded. Nitrogen is added to the canisters to provide positive pressure for removing the sample.

To achieve the desired detection levels, volatile organic species are separated from the ambient air matrix and concentrated. This is accomplished by passing the canister air sample through a Perma-Pure drying tube to remove water vapor and then through a trap cooled in liquid argon. The amount of sample passed through each trap varies depending on the levels of hydrocarbons which are present. Normally, a volume of 500 mL is used. The volume of sample passed through the traps is collected in a fixed volume reservior, and the pressure drop is measured and recorded with a high precision pressure gauge. When the desired volume of sample has been passed through the traps, khydrocarbon species are desorbed directly onto the analytical columns by heating the traps to 100 C while backflushing with carrier gas.

All analyses are performed on a Varian 3700 GC. Volatile organic species are separated onto two 60 m SE-30 fused silica capillary columns. The VOC's from the column are eluted into a flame ionization detector (FID) which detects and quantitates hydrocarbon species. The chromatograph output is monitored for 40 minutes, or until no peaks are observed. The VOC's from one column are passed through a fused silica splitter which is connected to both a flame ionization detector (FID) and a photoionization detector (PID). The FID is used to detect and quantitate hydrocarbon species. The PID is used to generate toluene normalized response (TNR) factors for the components of interest, providing additional qualitative information.

The VOCs from the second columln are analyzed by a Hall Electrolytic Conductivity Detector (HECD) operated in the halogen mode. This provides specific detection of halogenated VOCs which may not have otherwise exhibited adequate response characteristics on the FID/PID.

The output from the gas chomatograph will be processed with a Varian 401 Chromatographic Data System (CDS). This CDS provides peak areas and

retention times. A second data system, Apple II Plus microcomputer, will be used to ildentify peaks on the basis of retention times and to compute quantitative results by comparing peak areas with a previously established standard response.

When a VOC is identified on both the HECD and FID/PID, the HECD Concentration value will be reported. When a halogenated VOC is identified by FID/PID, but not confirmed by HECD, it will be reported as an unidentified VOC.

The list of hydrocarbon species on file in the data system is given in Table 1. Detection limit information is also provided in Table 1. Species that cannot be identifed are quantitated and listed as "unidentified".

4.3 Chain of Custody

Chain of custody documentation must accompany all samples. The chain of custody records will contain the following information:

- o Time, date, and location of sampling, and name of person performing sampling.
- o Number and type of sample.

TABLE 1. VOLATILE ORGANIC COMPOUND DATA BASE[1]

Alkanes

C-2 VOC
C-3 VOC
Isobutane
n-Butane
Neopentane
Isopentane
n-Pentane
Neohexane
Cyclopentane
2,3-Dimethylbutane
Isohexane
3-Methylpentane
n-Hexane
Methylcyclopentane
2,4-Dimethylpentane
Cyclohexane
Isoheptane
2,3-Dimethylpentane
3-Methylhexane
2,2,4-Trimethylpentane
n-Heptane
Methylcyclohexane
2,5-Dimethylhexane
2,3,4-Trimethylpentane
3-Methylheptane
2,3,5-Trimethylhexane
n-Octane
n-Nonane
n-Decane
n-Undecane

Alkenes and Alkynes

Isobutene
1-Butene
1,3-Butadiene
trans-2-Butene
1-Butyne
cis-2-Butene
3-Methyl-1-butene
1-Pentene
2-Butyne
2-Methyl-1-Butene
Isoprene
trans-2-Pentene

Alkenes and Alkynes, Cont.

cis-2-Pentene
2-Methyl-2-butene
Cyclopentene
4-Methyl-1-pentene
cis-4-Methyl-2-Pentene
trans-4-Methyl-2-Pentene
2-Methyl-1-pentene
1-Hexene
2-Ethyl-1-butene
2-Methyl-2-Pentene
trans-2-Hexene
cis-2-Hexene
cis-3-Methyl-2-Pentene
Methlcyclopentene
Cyclohexene
1-Heptene
3-Heptene
2-Heptene
2,4,4-Trimethyl-1-pentene
2,4,4-Trimethyl-2-pentene
1-Methylcyclonexene
1-Octene
cis-2-Octene
1-Nonene
4-Nonene
α-Pinene
β-Pinene
1-Decene
Limonene
1-Undecene

Aromatics

Benzene
Toluene
Ethylbenzene
p-Xylene
m-Xylene
Styrene
o-Xylene
Isopropylbenzene
n-Propylbenzene
m-Ethyltoluene
p-Ethyltoluene
1,3,5-Trimethylbenzene

Continued

TABLE 1. VOLATILE ORGANIC COMPOUND DATA BASE[1], Cont.

Aromatics, Cont.

o-Ethyltoluene
trans-Butylbenzene
1,2,4-Trimethylbenzene
Isobutylbenzene
1,2,3-Trimethylbenzene
p-Isopropyltoluene
Indan
Indene
m-Diethylbenzene
n-Butylbenzene
p-Diethylbenzene
Naphthalene

Halogenatic

Chloromethane
Vinyl chloride
Bromomethane
Chloroethane
Trichlorofluoromethane
1,1-Dichloroethylene
Methylene chloride
trans-1,2-Dichloroethene
Chloroform
1,2-Dichloroethane
1,1,1-Trichloroethane
Carbon tetrachloride
1,2-Dichloropropane
Trichloroethylene
Bromodichloromethane
Bis(chloromethyl) ether
cis-1,3-Dichloropropene
trans-1,3-Dichloropropene
1,1,2-Trichloroethane
Dibromochloromethane
Tetrachloroethylene
Chlorobenzene
1,1,2,2-Tetrachloroethane

Halogenatic, Cont.

o-Chlorotoluene
m-Chlorotoluene
p-Chlorotoluene
Bis(2-chloroethyl) ether
m-Dichlorobenzene
p-Dichlorobenzene
o-Dichlorobenzene

Oxygenated Compounds[2]

Acetaldehyde
Methanol
Propionaldehyde
Acetone
Ethanol
Diethyl ether
2-Propanol
Isobutyraldehyde
1-Propanol
Butyraldehyde
Butanone
Isovaleraldehyde
2-Pentanone
1-Butanol
Valeraldehyde
3-Pentanone
1,4-Dioxane
Bis(Chloromethyl) ether
Methylisobutylketone
Hexanal
Bis(2-chloroethyl) ether

[1]The detection limit for these compounds is 1.0 ppbV-C for a sample injection volume greater than 500 mL and a dilution factor greater than 0.45.

[2]This method has not been fully validated for these compounds. As a result, these compounds are identified and reported, but their concentrations are not used in the total non-methane hydrocarbon calculation.

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Quality Assurance/Quality Control Program for Radian Analytical Services

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THE QUALITY ASSURANCE/QUALITY CONTROL PROGRAM
FOR RADIAN ANALYTICAL SERVICES

Radian Analytical Services' (RAS) objective is to provide high quality chemical analyses to all clients regardless of the size of the analytical task. To aid in achieving this goal, a strong quality assurance program and rigid quality control practices are integral parts of all analyses. This document describes these quality assurance/quality control protocols for the Radian Analytical Services laboratories.

The basic quality control program includes procedures for sample handling, calibration, spiking and replicate analyses, analysis of QC test samples, equipment maintenance, and supplies control. These procedures can be integrated with a client's additional requirements, such as spiking studies, analysis of replicate samples, linearity determinations, and stability studies.

The quality assurance program consists of the frequent submission of blind QA samples, duplicates, and spiked sample splits. Also included are personnel training, analytical methodologies, sample control procedures, data handling, and equipment maintenance and calibrations.

1.0 QA Organization/Policy

The objective of Radian's quality assurance/quality control program is to assure, assess, and document the precision, accuracy, and adequacy of data obtained from chemical analysis and to assure the technical accuracy of the results obtained for all samples.

Radian has organized the quality assurance function within the company to allow complete independence of program review. Radian's Quality Assurance Director reports directly to the Vice President of the Technical Staff. This position provides independent reviews at all levels of the technical staff and laboratory organization and allows immediate access to Radian's top management on QA-related matters.

The QA Director's involvement may be limited to a review of quality control practices or as extensive as active development and implementation of quality control procedures and statistical data analysis. The QA Director may be asked to contribute expertise and assistance when a need is perceived by either the client, the technical staff, or the management staff.

Because of the large number of samples analyzed by RAS, a QA coordinator has been assigned to monitor and maintain an effective QA/QC program for these laboratories. The RAS Quality Assurance Coordinator, directly responsible to the Corporate QA Director, serves as an independent auditor of all RAS laboratories. The responsibilities of the RAS QA Coordinator are as follows:

- Monitor QA/QC within RAS laboratories,
- Supervise the preparation of blind audit samples,

- inform the Director of RAS and the corporate QA Director of quality assurance problems,
- summarize and report QA activities in the laboratories,
- document all QA and QC procedures within RAS,
- act as liaison between the corporate QA Director and RAS,
- provide QA data to the corporate QA Director for inclusion in the corporate QA reports.

The RAS laboratory managers function as the quality control coordinators in each particular analytical area. Their efforts are coordinated and monitored by the QA Coordinator.

Quality control coordinators serve as a focal point for all QC activities pertaining to each RAS laboratory. They work as a committee coordinated by the RAS Quality Assurance Coordinator. Their activities include the following:

- monitor the QA/QC activities of the laboratory area,
- inform the Director of Analytical Services and the QA coordinator of QC problems and needs.
- summarize, document, and report quality control activities and data generated in the laboratory,

- provide documentation of all QC procedures in the laboratory,

- maintains summaries of QC activities and data in a form suitable for client review upon request.

2.0 Quality Control for Laboratory Analyses

Radian Analytical Services has developed and implemented quality control procedures for all of the analyses performed in the laboratory. The laboratory quality control program provides an effective and efficient laboratory protocol for QC regardless of the size or scope of the analytical requirements. Approved analytical methods are used whenever available. When approved methods are not available, a method is developed by the Radian technical staff, and a technical note written describing the method. The quality control procedures are designed to insure that the standard operating procedures and quality control protocols are being followed and accurate results are obtained.

The general quality control program utilized in each laboratory includes consideration of the following areas:

- personnel training and certification,
- analytical methodology documentation,
- sample handling and control,
- laboratory facilities and equipment,
- calibration and standards,
- data handling and documentation,
- quality control check samples,

The general approach to quality control in each of these areas is discussed in the remainder of this section.

2.1 Personnel Training and Certification

The successful implementation of any QA/QC program is determined by the training and dedication of the laboratory personnel. The quality and consistency of data should be independent of the analyst. With the proper training and supervision, an analyst will be able to obtain quality data by the use of proven methodology. Periodic assessment of training requirements and certification are performed to maintain a high level of laboratory awareness.

The training and certification methods employed in the RAS laboratories are briefly described below:

- study of laboratory standard operating procedures,
- study of QA manual,
- observation of experienced operators/analysts,
- study of operating manuals,
- instruction by the laboratory manager on all aspects of the analysis,
- perform the analysis under the direct supervision of the laboratory manager,
- perform analysis under supervision of experienced personnel,
- analysis of blind QC samples prepared by laboratory QC coordinator,
- participation in in-house seminars on laboratory methods and procedures.

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PERSONNEL TRAINING RECORD

Employee ____________

Employee Number ____________

Date of Employment ____________

Laboratory Orientation:

Upon completion of each phase of personnel training the employee and Laboratory Manager will initial and date the step completed.

- The RAS laboratory Standard Operating Procedures have been read and understood.

  Employee ______ Lab Mgr. ______ Date ______

- The RAS Quality Assurance manual has been read and the procedures for the laboratory in which the employee worker have been explained.

  Employee ______ Lab Mgr. ______ Date ______

- Operation manuals for instruments with which the employee performs analyses have been studied and the procedures for operation and maintenance are understood.

Instrument	Employee	Lab Mgr.	Date	Instrument	Employee	Lab Mgr.	Date

Figure 2-1.

Test Specific Training:

Each specific test performed in the RAS laboratories involves procedures which may be unique. The steps involved in training an employee are:

- Instruction by the Laboratory Manager on all aspects of the analysis,
- Observation of experienced operators/analysts,
- Perform the analysis under supervision of the laboratory manager,
- Perform analysis of QA samples submitted by the QA coordinator, and
- Participation in in-house seminars on laboratory methods and procedures.

The following table is to be completed by dating and initialing by the employee and Laboratory Manager upon completion of each step.

Method	Instruction	Observation	Perform the Analysis	Analysis of QA samples	Seminars

Figure 2-1. (Cont'd)

All RAS personnel must complete a quality control training program. This system includes motivation toward producing data of acceptable quality and involves "practice work" by new employees. New personnel are made aware of the quality standards established by RAS and the reasons for those standards. They are made aware of the various ways of achieving and maintaining quality data. After an employee has been trained to use a method and the work validated by the laboratory manager, the employee is certified to perform the analysis. As these people progress to higher degrees of proficiency, their accomplishments are reviewed and then documented. Documentation of proficiency training is maintained by the QC Coordinator for each laboratory technician using the two-page form shown in Figure 2-1.

2.2 Analytical Methodologies

All analytical procedures followed in the RAS laboratories are documented in a methods manual for the specific laboratory. A set of standard operating procedures (SOP) has been established for each analysis to insure consistency. Most methods used are directly from an approved analytical manual, e.g., EPA methods, APHA Standard Methods for Water and Wastewater, ASTM, etc.

Methodologies may contain the following information:

- method title,
- scope of method,
- summary of interferences, and applications,
- concentration ranges and detection limits,
- safety precautions,
- required equipment and materials,
- standardization directions,
- detailed analytical procedure,
- calculations, with examples,
- reporting method,
- precision and accuracy statement,
- references.

2.3 Sample Control and Record Keeping

The Radian Analytical Services Sample Control Center is a controlled access area. Only employees of the Sample Control Center have access to sample receiving, sample storage, documentation files, and the computer terminals. Analysts check out samples under the supervision of the sample control personnel. All samples are stored in locked storage areas. Sample tracking is maintained by a computerized laboratory management system and a sample checkout logbook. The RAS Sacramento laboratory is linked to the central processing unit of the computer in Austin via a dedicated phone line. This insures that the laboratories are in constant communication. All sample information and data entries can be immediately accessed at either location.

Detailed record keeping and control of samples are essential for effective laboratory operation. All samples received for analysis in the Radian Analytical Service laboratories are processed through the Sample and Analysis Management System (SAM). Radian Corporation's SAM is a software and hardware system for controlling and handling information for the analytical laboratory. SAM provides a dynamic, easy-to-use method for tracking, scheduling, reporting, and laboratory management. The system has been designed to accommodate and promote good laboratory management practices by providing high visibility of the information laboratory managers need to make good decisions regarding schedules and priority. The system is designed around a Data General Nova-IV computer with a 64K-byte memory. It also includes a 65M-byte disk drive and a line printer with plotting capabilities. Data is entered via a TEC terminal and CRT. All data stored on the disk is backed up on magnetic tape to prevent loss in the event of a system malfunction. The system is designed so that an individual designated as the principal operator can process the required paperwork for a large laboratory with little difficulty. The approach centralizes information input and data retrieval, and provides the mechanism for organized, up-to-date laboratory performance monitoring.

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SAM maintains complete client information files, generates laboratory status reports, flags sample analyses which are overdue, accepts analysis results manually or automatically, and generates reports and invoices.

The Sample Control Center and SAM have six basic functions:

- sample receipt and logging,
- sample storage and maintenance of sample integrity,
- laboratory status reporting,
- document control,
- data compilation and reporting, and
- invoicing

In order to assure the integrity of a sample and the accompanying documentation, a security plan has been established. This plan consists of three parts:

- chain or custody,
- secured refrigerated storage, and
- document control.

The progression of samples and documentation through the Sample Control Center and the analytical laboratories is presented in Figure 2-2. Detailed descriptions of each sample control function are presented below:

- Samples are received from the commercial carrier at Radian's shipping and receiving facilities by the receiving clerk.

- Within one hour of arrival, the samples are accepted by RAS sample control personnel.

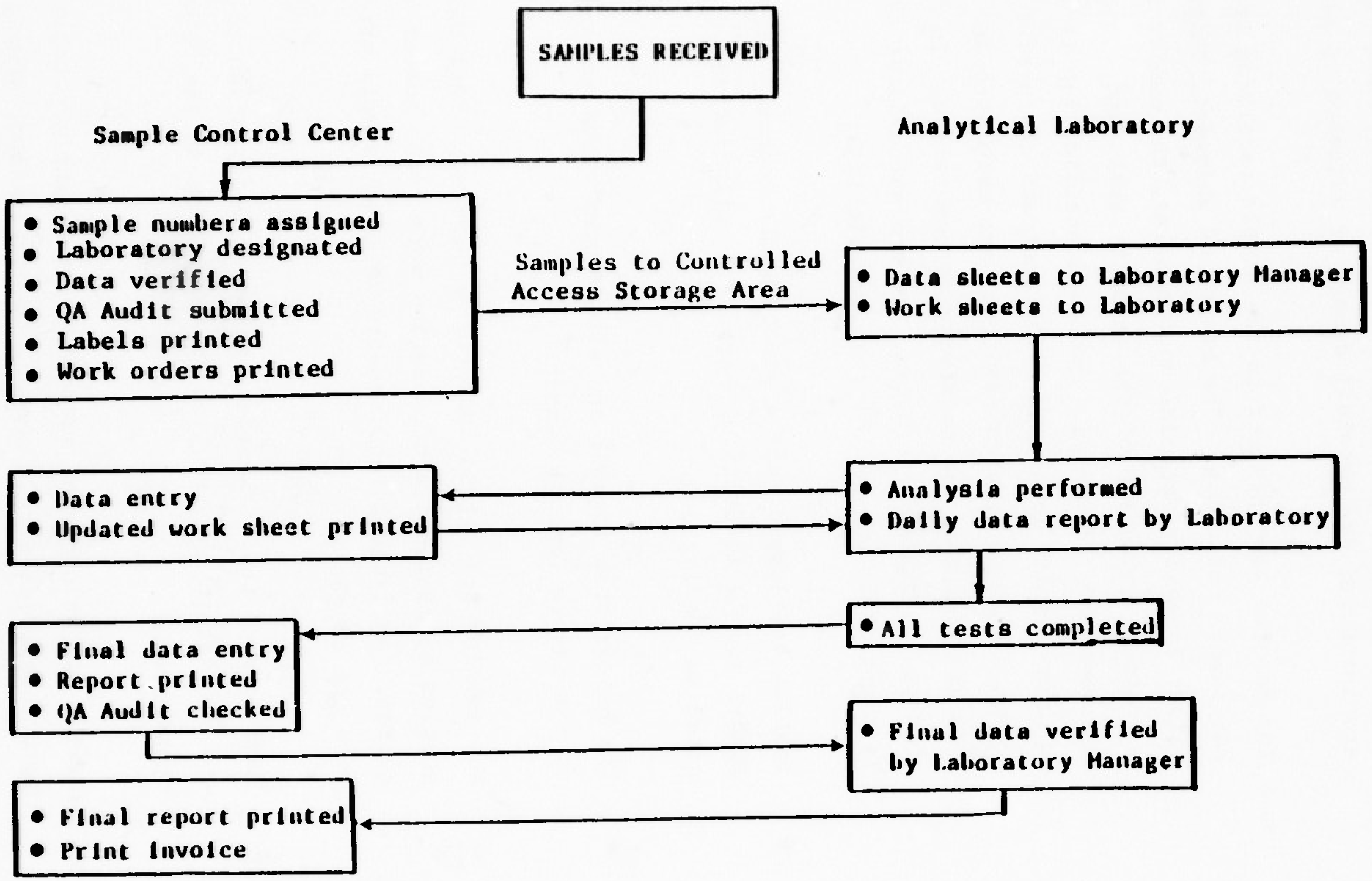

Figure 2-2. SAM Laboratory Management System

- All shipping containers and security seals, when appropriate, are inspected for physical damage or evidence of tampering.

- The samples are unpacked in the sample receiving area by the RAS sample custodian. The method of shipment, shipping container integrity, condition of samples, the number of samples/ container, integrity of the security seal, and accompanying documentation are noted. Sample identification is verified against custody documents. The enclosed chain-of-custody forms, Figure 2-3, when required, are completed and filed with the shipping and receiving documentation. In the event that peculiarities are noted, the project officer or client is immediately advised of the irregularity.

- Samples are logged into a bound sample logbook, Figure 2-4. Again, sample identity is verified. All discrepancies are noted in the logbook.

- The handwritten logbook and all documentation are transferred to the Sample Control Center.

- The samples are logged into the SAM system. Each batch of samples is assigned a consecutive work order number by the system. Analytical requirements for each sample are entered into the computer.

- Hard copy of the work order and other information is printed and filed with the received documentation in the Sample Control Center.

- Labels are printed and secured to each sample. Label information includes sample number, identification, storage location, and analytical requirements.

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CHAIN OF CUSTODY RECORD

Field Sample No. ____________

Company Sampled/Address ____________

Sample Point Description ____________

Stream Characteristics:

Temperature ____________ Flow ____________ pH ____________

Visual Observations/Comments ____________

____

Collector's Name ____________ Date/Time Sampled ____________

Amount of Sample Collected ____________

Sample Description ____________

Store at: ☐ Ambient ☐ 5°C ☐ −10°C ☐ Other ____________

☐ Caution · No more sample available ☐ Return unused portion of sample ☐ Discard unused portions

Other instructions · Special Handling · Hazards ____________

____

____

☐ Hazardous sample (see below) ☐ Non-hazardous sample

☐ Toxic ☐ Skin irritant ☐ Flammable (FP< 40°C)

☐ Pyrophoric ☐ Lachrymator ☐ Shock sensitive

☐ Acidic ☐ Biological ☐ Carcinogenic · suspect

☐ Caustic ☐ Peroxide ☐ Radioactive

☐ Other ____________

Sample Allocation/Chain of Possession:

Organization Name ____________

Received By ____________ Date Received ____________ Time ____________

Transported By ____________ Lab Sample No. ____________

Comments ____________

Inclusive Dates of Possession ____________

Organization Name ____________

Received By ____________ Date Received ____________ Time ____________

Transported By ____________ Lab Sample No. ____________

Comments ____________

Inclusive Dates of Possession ____________

Organization Name ____________

Received By ____________ Date Received ____________ Time ____________

Transported By ____________ Lab Sample No. ____________

Comments ____________

Inclusive Dates of Possession ____________

Figure 2-3. Chain or Custody Record

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Lab No. ________

Company ______________________
Facility ______________________
____
Rep ______________________
Phone ______________________
Report ______________________
to ______________________
____
____
Attn ______________________
Inv ______________________
to ______________________
____
____
Attn ______________________
P.O. # ______________________
Expires ______________________

Quoted $ ________
Sample $ ________
Misc $ ________
Total $ ________
Inv by (CPR) ________
% Surcharge ________
% Disc: All ________

Contact ________
Received ________
Date Due ________
Samples ________
Keep for ________
Keep til ________
Disp (RD) ________

Reports ________
Invoices ________

Work ID ______________________
Taken ______________________
Trans ______________________
Type ______________________
Condition ______________________
Comments:

Location: ______________

Dash No.	Sample Description	Analysis Required	QA

Figure 2-4. Sample Log Sheet

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- Data sheets and work sheets are printed for each batch of samples and distributed to the appropriate laboratory managers. The work sheets list sample numbers, sample identification, storage location, and analytical requirements. Data sheets are for results and contain only the parameters to be determined by a given laboratory.

- Following sample logging, the samples are placed in the designated locked storage area.

- Subsequent sample custody is documented and all transactions witnessed by sample control personnel.

- The analyst retrieves the samples from the Sample Control Center by sample number and storage location.

- The Sample checkout log (Figure 2-5) is completed by the analyst, noting the laboratory to which the sample is being removed.

- After analysis, or when the required aliquot is removed, the sample is returned to the Sample Control Center and return is noted in the sample checkout log.

- The sample is returned to the designated storage location.

- When requested, addition chain-of-custody documentation can be provided using a SAM-generated document (Figure 2-6). This document can be retained by sample control to provide a more easily retrievable record of sample custody within the analytical laboratory.

- The sample is stored until the assigned time or written permission is given to either properly dispose of or return the sample to the client.

RAS SAMPLE CHECK OUT LOG

WORK ORDER	SPLITS REMOVED	CHECK-OUT INFORMATION				RETURN INFORMATION		
		DATE	TIME	DESTINATION	INITIALS	DATE	TIME	INITIALS

7S/196 (Water and Prep. Labs)

7S/194 (Extraction & Water Labs

7S/180 (ICP and AA Labs)

7S/191 (TOX, TOC)

7S/195 · (Technician)

7S/171 (GC)

Figure 2-5. Sample Checkout Log

PAGE 1 CORPORATION Analytical Serv CHAIN OF CUSTODY LAB # 83-02-A67
RCVD: 02/26/83 DUE: 03/19/83 04/21/83 09:56:49 KEEP: 05/09/83 DISP: D

DASH	SAMPLE IDENTIFICATION	LOCATION	TESTS						
01A-B	Number 001	Ref 2	CAUSTY	CO3_A	HARD_B	HCO3_A	MHO_A	ONG_A	PH_A
			PO4_B	SO3_TA	TANNIN				
02A	Number 002	Ref 2	ACFS						
02B	Number 002	Ref 2	ICP_40						
03A	Super soil	Ref 2	ANFS						
04A	Boiler scale 222	Ref 2	CA_E	CL_TA	CO3_A	FE_E	HCO3_A	MG_E	NA_E
			P_E	SO4_NA	S_E	ZN_E			
05A	Sample AV56	Shelf 13	B_MET	C_MET					
06A	Water #164	Ref. 023	AG_E	AS_HA	BA_E	CD_E	CR_E	FE_E	HG_CA
			MN_E	NA_E	PB_GA	SE_HA			
06B	Water #164	Ref. 023	CL_TA	F_SIEA	MHO_A	NO3_A	PH_A	SO4_NA	TDS_A
06C	Water #164	Ref. 023	H1RCRA	P1RCRA					
06D	Water #164	Ref. 023	ALPHA	BETA	RA_TOT				

RECEIVED BY	DATE	RETURNED TO	DATE	FRACTION NUMBERS.

Figure 2-6. Laboratory Chain of Custody

- All documentation, including shipping documents, field sampling documents, computer-generated log sheets, chain-of-custody forms, laboratory data sheets, final computer reports, and other documents, are maintained in the sample control area. All reports are kept in locked filing cabinets. As with the sample storage area, the document storage area is limited-access.

All storage areas are within the Sample Control Center and are locked when not in use. Access to the storage area is limited to sample control personnel or other RAS employees accompanied by sample control personnel. There are four storage locations that are used depending on the sample and the required analyses. They are:

- ambient storage for samples that do not require refrigeration,

- 4°C storage for most samples requiring water quality analysis and extractable organics,

- 4°C storage for samples requiring volatile organic analysis, and

- -20°C storage for extracts and samples that require freezing.

A temperature log is maintained to monitor the cold storage facilities.

2.4 Laboratory Facilities and Equipment

A clean well-lighted, and well maintained laboratory is essential for accurate analytical results. Each laboratory is well-lighted, air conditioned and equipped with chemical fume hoods. Instrumentation that may emit noxious odors is vented externally.

Quality Control of Equipment and Supplies

Each laboratory QC program includes detailed requirements for equipment and supplies. Reagents, solvents, and standards with specific levels of purity are used as specified by the analytical protocol. Specific GC column materials, glassware and sample handling equipment are also specified. The quality control procedures for equipment and supplies generally include the following items:

- operator checklists for required supplies,
- documentation and reporting of all deviations from specified instrument performance,
- procedures for testing for purity of reagents,
- tolerances for calibrated glassware where applicable,
- monitoring of refrigerated storage space,
- maintenance logbooks,
- service contracts on analytical instrumentation.

Quality control procedures during sample preparation include the preparation of reagent or solvent blanks. Additional quality control techniques implemented in sample preparation include:

- deionized water piped into all laboratories, monitored daily,
- purchasing high purity distilled-in-glass solvents in large quantities from a single lot,

- use of Ultrex acids in trace metal digestion,
- cleaning of organic glassware with chromic acid or firing in a kiln at 450°C,
- cleaning of trace metal glassware with nitric acid,
- use of organic-free water prepared at Radian by distillation over alkaline permanganate under nitrogen atomsphere in all-glass still,
- use of volatile-free water prepared by purging organic-free water with nitrogen,
- sample preparation performed by experienced technical personnel under the supervision of senior level analysts.

2.5 Quality Control for Standards and Calibration

The quality of all test results is greatly impacted by the calibration procedures used. Calibration procedures and standards should be specified for all equipment and supplies used in the test procedure. Traceability to common standards is essential for test procedures to be used in multiple laboratories. Quality control procedures for standards and calibrations include the following considerations:

- written, detailed calibration instructions,
- preparation procedures for secondary standards, when applicable,
- requirements for frequency of calibration,
- recordkeeping of all calibrations and standards used,

- quality control charts for recording results from multiple calibrations,
- evaluation of internal standards, and
- tolerances for calibration requirements.

All calibration standards are prepared from NBS-traceable, EPA certified, or primary standard materials. Daily logs are maintained to monitor instrument response to a given standard.

Quality Control Test Samples

Routine quality control samples to be analyzed concurrently with client samples are a significant portion of the RAS laboratory quality control programs. The purpose of these checks is twofold: 1) to assure that samples being analyzed satisfy predetermined standards of accuracy, and 2) to measure and document achieved levels of accuracy and precision.

There are many different types of quality control samples which could be used for these purposes. The correct combination of these will depend on the complexity of the test method and the desired degree of accuracy. The following quality control parameters are general considerations for Radian's quality control for test methods.

Interferences

The analytical results of a test method might be affected by interferences from the glassware, solvents, reagents, or the sample matrix. Blank samples which are subjected to conditions similar to samples being analyzed are used to evaluate the purity of laboratory reagents. The frequency of blank analysis is method dependent. For example, a laboratory or field blank is analyzed after each GC/MS volatile organic analysis with high levels for any of the pollutants. Ten percent of the samples from a

given sample batch are spiked with a known standard. Spike recovery data are calculated to determine matrix interference.

Precision

The precision or repeatability of a test method is required for proper interpretation and weighting of the data. Replicate samples or standards are used to determine the precision on a regular basis. The precision of multiple analyses are compared against predetermined precision limits to determine their acceptability. The precision is usually reported as a standard deviation or repeatability statistic and often depends on the concentration of the parameters analyzed. Replicate analyses are defined as separate digestions or extractions of the same sample, when possible. The percentage difference or range between replicate analyses is also used to monitor precision.

Reproducibility

The reproducibility of a test method refers to the repeatability over a period of time. How well will analytical results repeated a month later agree with today's results? Reproducibility can be measured by the repeated analysis of samples from a previous time period or by analysis by more than one laboratory or laboratory technician.

Qualitative Specificity

In the analysis of complex sample matrices containing multiple components, the use of a single method can lead to misidentification of compounds. The misidentification can be detected by repeated analysis of standards containing the compounds of interest or by independent analysis by a more specific method. For example, mass spectral confirmation can be used to evaluate misidentification problems in the GC laboratory.

2.6 Documentation and Data Handling

Documentation of methods, procedures, and results is an essential aspect of a QA/QC program.

Adequate documentation is required for an instrument maintenance system. RAS laboratories use an individual logbook, which is kept at each instrument, to record all calibration and maintenance activities. This logbook gives a chronology of that instrument's installation, operation, calibrations, maintenance, malfunction, and repairs. An accompanying binder includes all pertinent manufacturing information, service manuals, and similar reference materials.

Directions for calibrations and maintenance, along with appropriate forms and checklists, are maintained in a manual accompanying the logbook. The directions specify the required frequency for calibrations and maintenance, the tolerances for calibrations, and the action to be taken when calibration requirements are not met.

In this system, there is a single source for reference purposes as well as record keeping. All the instrument logbooks are reviewed periodically by the quality assurance coordinator and laboratory manager. A record of these logbook checks is maintained by the QA coordinator.

Work sheets have been developed to insure consistent laboratory data entry for most parameters determined in the laboratories. These sheets are designed to organize the data in a clear and logical manner, and to simplify calculations. The work sheets are divided into various sections including a section for reporting calibration standards and blank values and a section for plotting calibration curves. These work sheets are usually a standard data entry form which the laboratory technician enters in his/her bound lab notebook. When automated calibration is not applicable, electronic calculators are available in the laboratories to generate calibration curves by the method of least squates. Thus errors in reading calibration curves and calculating data are minimized. After an analysis

is completed and a data sheet filled out, the laboratory manager checks the data for completeness and approves the data sheet. After the data have been entered into the SAM system, an updated data sheet is issued to the laboratory manager. When the work is complete, a preliminary report is printed and distributed to the contributing laboratory managers for the final data check and approval. A final report is printed, certified by the laboratory manager, and forwarded to the client.

Proper documentation of quality assurance and quality control activities is an essential requirement. Documentation is needed to demonstrate that quality control activities were completed as scheduled and to communicate the results of the QC tests to laboratory managers and clients. Documentation of QA results is required to provide feedback for improvement of quality control programs.

Quality control documentation should be timely in order for feedback to occur. Daily reporting to laboratory managers is mandatory. Forms are designed to organize the QC data in a clear and logical manner, and to simplify calculations. Control charts are another excellent tool for summarizing quality control test results.

As part of Radian's QA audit program weekly reports summarizing audit results in the laboratories are prepared and distributed to QC coordinators.

3.0 Quality Assurance Audits

The quality assurance audit program of the RAS laboratories is conducted by the RAS QA Coordinator in conjunction with the corporate QA Director. The program consists of the following:

- QA standards are prepared using EPA certified standards, NBS standards, primary standard materials, and NBS-traceable compounds. All standards preparations are recorded in the QA Sample logbook (Figure 3-1).

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Standard No. QAS ______________

QA type ____________________________

Prep date ______________ Prepared by ________________ Verified by ______________

Standard source ____

____

Sample matrix ____

Parameters

Preparation method   Final vol ______________

Figure 3-1. Standards preparation logbook

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CORPORATION

QAS ______________

Prep method (con't)

Calculations

Sample Distribution

Date	SAM No.	Client	Remarks

Figure 3-1. (Cont.)

- An inventory of stock standards is maintained within the limits of published stability data. This decreases the time required for daily standard preparation.

- Duplicate samples are requested from clients. These are blind to the laboratory and the client is not billed for the duplicate.

- Blind QA samples are submitted through the Sample Control Center to all laboratories. The parameters and concentration levels are selected by the RAS Quality Assurance Coordinator.

- Laboratory managers submit, via a "QA Alert Form" (Figure 3-2). a list of the types of QA samples needed the following week. This insures that the parameters with which there have been problems are included in the sample.

- Monthly reports are issued from the RAS QA Coordinator (Fig. 3-3). These are submitted to the corporate QA Director, laboratory managers and Director of RAS. Managers are notified immediately of major problems with the results of analysis of a QA sample.

- The results of the program are summarized on a quarterly basis for Radian's management.

In addition to the continuous audit program, provisions for third party review are made with each client's work. Radian Analytical Services welcomes onsite audits, performance samples, and independent evaluations.

RADIAN CORPORATION

QA ALERT FORM

QA standard for the week of____________

NPDES
Form A water __
Form B water __
metals __
Form C water __
metals __
organics __

TOC __ TOX __

RCRA metals __ pesticide
anions __ OC __ OP __
herbicide __

EPA 601 __ 624 __
602 __ 625 __

B/N __ Acids __ A/N __

MS VOA __ GC VOA __

PCB __

Matrix requirements: ____________________

Concentration requirements: ____________________

Special Standards/Instructions	Individual Parameters

Date ____________ Mgr ____________

Figure 3-2. QA alert form

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CORPORATION

ANALYTICAL SERVICES
MONTHLY QA REPORT

QA prep report for the month of ______________

Order No.	Lab	Parameter	Certified Value	Analyzed Value	% Recovery	Date Reported

Figure 3-3. Monthly QA Report

3.1 Data Review and Validation

All analysis results are entered into the SAM computer system. Following completion of the analyses, a preliminary report is printed and returned to the appropriate laboratory manager for review and validation. A final report is printed after the certification by the manager. This report is signed and approved by the laboratory manager before being forwarded to the client. The following diagram (Fig. 3-4) illustrates the data flow for a typical sample analysis.

Upon completion of the analysis and before the final data are issued, the results of the QA audit samples are compared to the certified values. These results are plotted on control charts. Separate control charts are maintained for each analysis. If results are outside the accepted control limits, the analytical results are held until the problem is resolved.

3.2 Control Charts

Quality control charts are maintained for both accuracy and precision. Both charts are structured as shown in Figure 3-5. The main portions of the chart are the center line and the two control limits. The center line is the 100% or total recovery/total agreement of analytical results. The upper and lower control limits are calculated from historical data.

Control charts for accuracy are constructed as follows:

Precent recovery of standards (P_{ST}):

$$P_{ST} = 100 \times \frac{\text{analyzed value}}{\text{certified value}}$$

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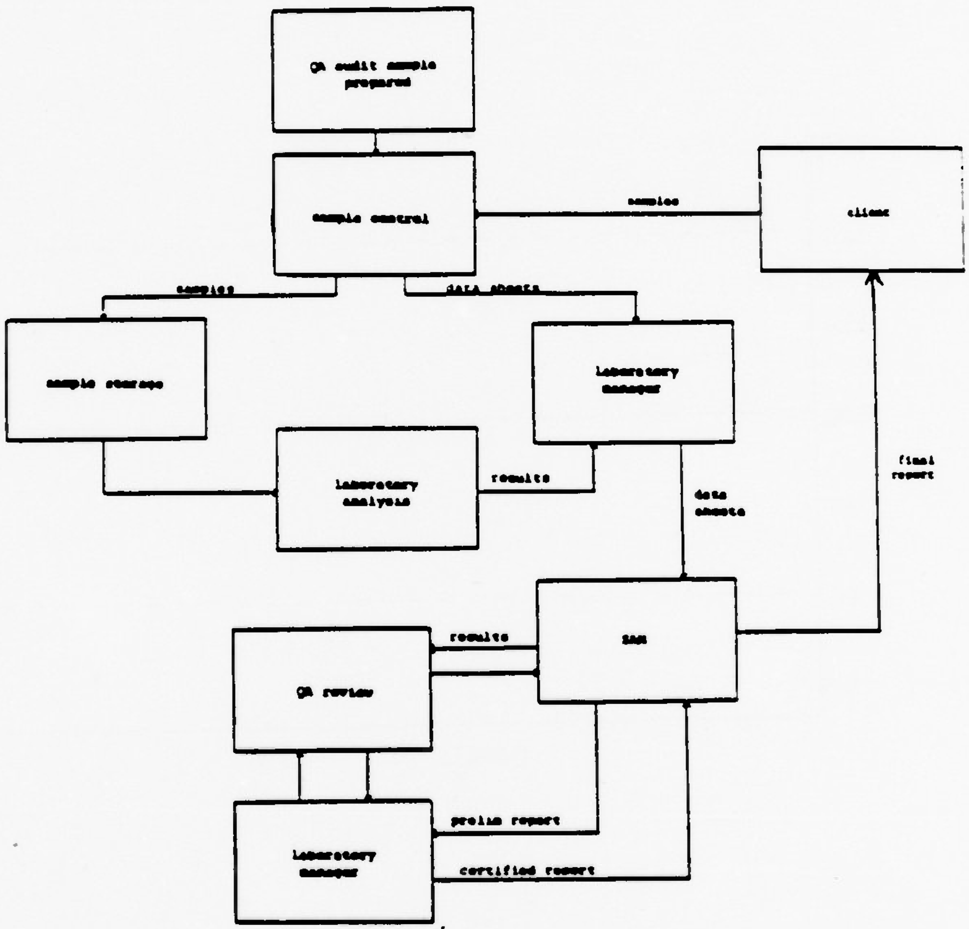

Figure 3-4. Data Flow

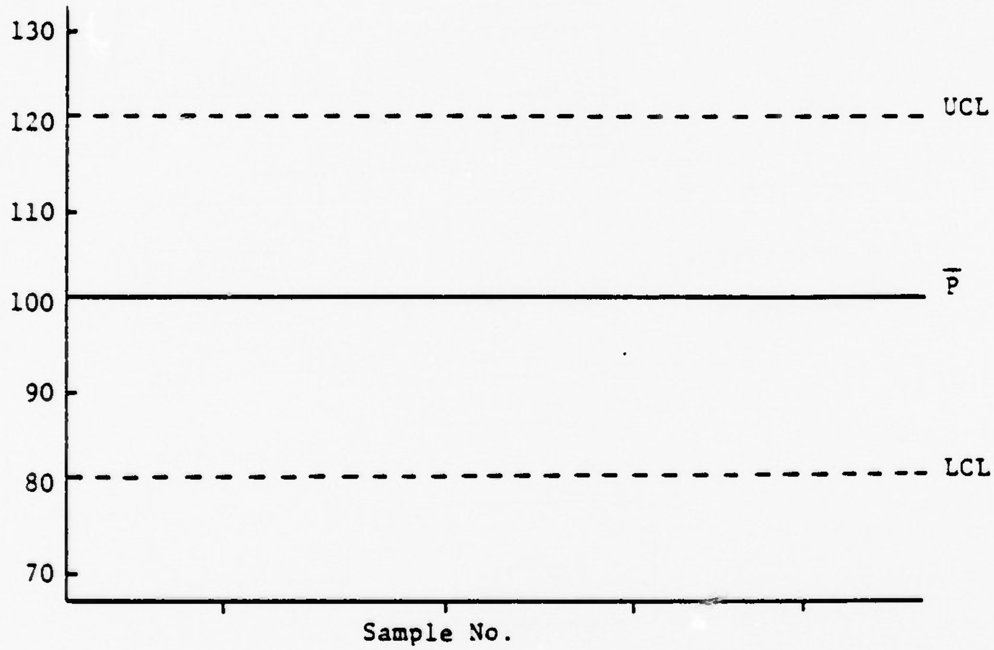

Figure 3-5. Control Chart

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Percent recovery of spikes in samples (P_{SP}):

$$P_{SP} = 100 \times \frac{\text{analvzed value - background value}}{\text{spike}}$$

From a set of analyses, the average percent recovery ($\bar{P}$):

$$\bar{P} = \frac{\sum_{i=1}^{n} P_i}{n}$$

The standard deviation for percent recovery (S_R):

$$S_R = \sqrt{\frac{\sum_{i=1}^{n} P_i^2 - \left(\sum_{i=1}^{n} P_i\right)^2 / n}{n-1}}$$

The upper and lower control limits are therefore

$$UCL = \bar{P} + 3S_R$$
$$LCL = \bar{P} - 3S_R$$

An analysis is out of control when either of the two conditions apply:

1) Any results outside the control limits
2) Seven successive results on the same side of the control line.

Control charts for precision are also constructed. Precision is a function of the concentration range of the analyte. The closer the result is to the analytical detection limit, the more imprecise the data become on a percentage scale. Figure 3-6 illustrates the relationship between detection limit and precision for a typical methodology. Because of this concentration dependence, precision control charts need to be developed for specific concentration ranges for each analyte. For duplicate samples A and B, the ratio of the values of A and B are plotted.

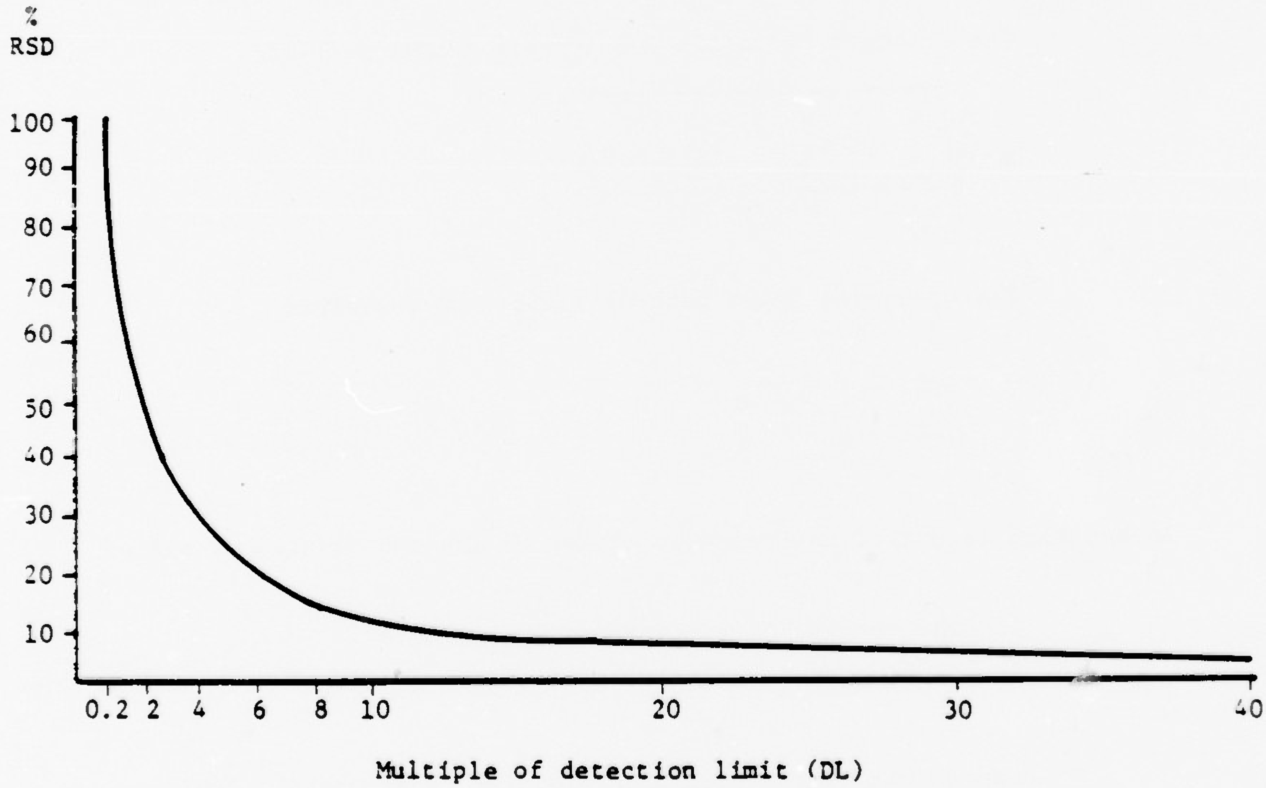

Figure 3-6. Relationship between Detection Limit and Precision

3.3 Concurrent Review

Upon review of analytical results of QA audit samples, the QA Coordinator will schedule a meeting with the laboratory manager if there are any tests out of control or which are deviant from an expected precision/accuracy norm. The purpose of this meeting is to:

- review raw data and determine if there is an explanation for the deviance.
- outline analyses of quality control and/or quality assurance samples to further define the problem and its solution.
- establish a schedule for monitoring the analysis after a solution is implemented, to assure that the problem does not recur.

Involvement of the laboratory manager in the problem assessment and solution is essential to a mutual committment to a quality analytical laboratory.

APPENDIX G

CHAIN-OF-CUSTODY FORMS

RADIAN
CORPORATION

CHAIN OF CUSTODY RECORD

Field Sample No. A036-A,B,C,D

Company Sampled/Address USAF Bergstrom AFB

Sample Point Description Corehole #1 MotorPool

Stream Characteristics:

Temperature ______ Flow ______ pH ______

Visual Observations/Comments ______

Collector's Name Wayne Pearce Date/Time Sampled 3/20/84

Amount of Sample Collected 1-Quart, 1-500ml, 2-VOA Vials

Sample Description Ground Water

Store at: ☐ Ambient ☑ 5°C ☐ −10°C ☐ Other: ______

☐ Caution · No more sample available ☐ Return unused portion of sample ☐ Discard unused portions

Other Instructions · Special Handling · Hazards Unknown Hazard

☐ Hazardous sample (see below) ☐ Non-hazardous sample

☐ Toxic	☐ Skin irritant	☐ Flammable (FP< 40°C)
☐ Pyrophoric	☐ Lachrymator	☐ Shock sensitive
☐ Acidic	☐ Biological	☐ Carcinogenic · suspect
☐ Caustic	☐ Peroxide	☐ Radioactive

☐ Other ______

Sample Allocation/Chain of Possession:

Organization Name Radian

Received By [signature] Date Received 3-30-84 Time 4:30

Transported By WP Lab Sample No. 8403205-01

Comments ______

Inclusive Dates of Possession ______

Organization Name ______

Received By ______ Date Received ______ Time ______

Transported By ______ Lab Sample No. ______

Comments ______

Inclusive Dates of Possession ______

Organization Name ______

Received By ______ Date Received ______ Time ______

Transported By ______ Lab Sample No. ______

Comments ______

Inclusive Dates of Possession ______

RADIAN
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CHAIN OF CUSTODY RECORD

Field Sample No. A048-A,B,C,

Company Sampled/Address USAF - Bergstrom AFB

Sample Point Description Corehole #3 Fire Training

Stream Characteristics:

Temperature ______ Flow ______ pH ______

Visual Observations/Comments ______

Collector's Name Wayne Pearce Date/Time Sampled 3/21/84

Amount of Sample Collected 1-Quart, 1-500ml, 2-40ml

Sample Description Groundwater

Store at: ☐ Ambient ☑ 5°C ☐ -10°C ☐ Other ______

☐ Caution - No more sample available ☐ Return unused portion of sample ☐ Discard unused portions

Other Instructions - Special Handling - Hazards Unknown Hazard

☐ Hazardous sample (see below) ☐ Non-hazardous sample

☐ Toxic	☐ Skin irritant	☐ Flammable (FP< 40°C)
☐ Pyrophoric	☐ Lachrymator	☐ Shock sensitive
☐ Acidic	☐ Biological	☐ Carcinogenic - suspect
☐ Caustic	☐ Peroxide	☐ Radioactive

☐ Other ______

Sample Allocation/Chain of Possession:

Organization Name Radian

Received By [illegible signature] Date Received 3 22 84 Time 3 30

Transported By WP Lab Sample No. 840322-02

Comments ______

Inclusive Dates of Possession ______

Organization Name ______

Received By ______ Date Received ______ Time ______

Transported By ______ Lab Sample No. ______

Comments ______

Inclusive Dates of Possession ______

Organization Name ______

Received By ______ Date Received ______ Time ______

Transported By ______ Lab Sample No. ______

Comments ______

Inclusive Dates of Possession ______

RADIAN
CORPORATION

CHAIN OF CUSTODY RECORD

Field Sample No. A049-A,B,C,.

Company Sampled/Address USAF Bergstrom AFB

Sample Point Description Core hole #2 POL

Stream Characteristics:

Temperature ______ Flow ______ pH ______

Visual Observations/Comments ______

Collector's Name Wayne Pearce Date/Time Sampled 3/21/84

Amount of Sample Collected 1-Quart, 1-500ml, 2-40ml

Sample Description Ground Water

Store at: ☐ Ambient ☑ 5°C ☐ -10°C ☐ Other ______

☐ Caution - No more sample available ☐ Return unused portion of sample ☐ Discard unused portions

Other Instructions - Special Handling - Hazards Unknown Hazard

☐ Hazardous sample (see below) ☐ Non-hazardous sample

☐ Toxic ☐ Skin irritant ☐ Flammable (FP< 40°C)
☐ Pyrophoric ☐ Lachrymator ☐ Shock sensitive
☐ Acidic ☐ Biological ☐ Carcinogenic - suspect
☐ Caustic ☐ Peroxide ☐ Radioactive
☐ Other ______

Sample Allocation/Chain of Possession:

Organization Name Radian
Received By [illegible] Date Received 3-22-84 Time 3:30
Transported By WP Lab Sample No. 3403305-03
Comments ______
Inclusive Dates of Possession ______

Organization Name ______
Received By ______ Date Received ______ Time ______
Transported By ______ Lab Sample No. ______
Comments ______
Inclusive Dates of Possession ______

Organization Name ______
Received By ______ Date Received ______ Time ______
Transported By ______ Lab Sample No. ______
Comments ______
Inclusive Dates of Possession ______

RADIAN
CORPORATION

CHAIN OF CUSTODY RECORD

Field Sample No. A051 (A,B,C,D,E)

Company Sampled/Address USAF Bergstrom AFB
Sample Point Description Corehole #4 - Fire Training

Stream Characteristics:
Temperature ______ Flow ______ pH ______
Visual Observations/Comments ______

Collector's Name Wayne Pearce Date/Time Sampled 3/22/84
Amount of Sample Collected 1-Quart, 1-500 ml, 3-40 ml VOA Vials
Sample Description Ground Water
Store at: ☐ Ambient ☑ 5°C ☐ −10°C ☐ Other ______

☐ Caution - No more sample available ☐ Return unused portion of sample ☐ Discard unused portions

Other Instructions - Special Handling - Hazards Unknown Hazard

☐ Hazardous sample (see below) ☐ Non-hazardous sample

☐ Toxic	☐ Skin irritant	☐ Flammable (FP< 40°C)
☐ Pyrophoric	☐ Lachrymator	☐ Shock sensitive
☐ Acidic	☐ Biological	☐ Carcinogenic - suspect
☐ Caustic	☐ Peroxide	☐ Radioactive
☐ Other ______		

Sample Allocation/Chain of Possession:

Organization Name Radian
Received By [illegible] Date Received 3-23-84 Time 8:30
Transported By WP Lab Sample No. 8403205 04
Comments ______
Inclusive Dates of Possession ______

Organization Name ______
Received By ______ Date Received ______ Time ______
Transported By ______ Lab Sample No. ______
Comments ______
Inclusive Dates of Possession ______

Organization Name ______
Received By ______ Date Received ______ Time ______
Transported By ______ Lab Sample No. ______
Comments ______
Inclusive Dates of Possession ______

RADIAN
CORPORATION

CHAIN OF CUSTODY RECORD

Field Sample No. 4001

Company Sampled/Address USAF – Bergstrom AFB

Sample Point Description Corehole #1 Motor Pool

Stream Characteristics:

Temperature ______ Flow ______ pH ______

Visual Observations/Comments ______

Collector's Name Wayne Pearce Date/Time Sampled 3/19/84

Amount of Sample Collected Quart (Solid)

Sample Description Soil – 0-1.5 ft BLS

Store at: ☐ Ambient ☐ 5°C ☑ – 10°C ☐ Other ______

☐ Caution · No more sample available ☐ Return unused portion of sample ☐ Discard unused portions

Other Instructions · Special Handling · Hazards Unknown Hazard –

☐ Hazardous sample (see below) ☐ Non-hazardous sample

☐ Toxic ☐ Skin irritant ☐ Flammable (FP< 40°C)
☐ Pyrophoric ☐ Lachrymator ☐ Shock sensitive
☐ Acidic ☐ Biological ☐ Carcinogenic · suspect
☐ Caustic ☐ Peroxide ☐ Radioactive
☐ Other ______

Sample Allocation/Chain of Possession:

Organization Name Radian
Received By [illegible] Date Received 3-20-84 Time 8:30
Transported By WP Lab Sample No. 8403303-01
Comments ______
Inclusive Dates of Possession ______

Organization Name ______
Received By ______ Date Received ______ Time ______
Transported By ______ Lab Sample No. ______
Comments ______
Inclusive Dates of Possession ______

Organization Name ______
Received By ______ Date Received ______ Time ______
Transported By ______ Lab Sample No. ______
Comments ______
Inclusive Dates of Possession ______

RADIAN
CORPORATION

CHAIN OF CUSTODY RECORD

Field Sample No. A003

Company Sampled/Address USAF - Bergstrom AFB

Sample Point Description Corehole #1 - Motor Pool

Stream Characteristics:

Temperature ______ Flow ______ pH ______

Visual Observations/Comments ______

Collector's Name Wayne Pearce Date/Time Sampled 3/19/84

Amount of Sample Collected Quart (Solid)

Sample Description Soil . 5-6.5 ft BLS

Store at: ☐ Ambient ☐ 5°C ☑ −10°C ☐ Other ______

☐ Caution · No more sample available ☐ Return unused portion of sample ☐ Discard unused portions

Other Instructions · Special Handling · Hazards Unknown Hazard

☐ Hazardous sample (see below) ☐ Non-hazardous sample

☐ Toxic	☐ Skin irritant	☐ Flammable (FP< 40°C)
☐ Pyrophoric	☐ Lachrymator	☐ Shock sensitive
☐ Acidic	☐ Biological	☐ Carcinogenic · suspect
☐ Caustic	☐ Peroxide	☐ Radioactive
☐ Other ______		

Sample Allocation/Chain of Possession:

Organization Name Radian

Received By [illegible signature] Date Received 3-20-84 Time 8:30

Transported By WP Lab Sample No. 8403205 02

Comments ______

Inclusive Dates of Possession ______

Organization Name ______

Received By ______ Date Received ______ Time ______

Transported By ______ Lab Sample No. ______

Comments ______

Inclusive Dates of Possession ______

Organization Name ______

Received By ______ Date Received ______ Time ______

Transported By ______ Lab Sample No. ______

Comments ______

Inclusive Dates of Possession ______

RADIAN CORPORATION

CHAIN OF CUSTODY RECORD

Field Sample No. A004

Company Sampled/Address USAF - Bergstrom AFB

Sample Point Description Corehole #1 Motor Pool

Stream Characteristics:

Temperature ______ Flow ______ pH ______

Visual Observations/Comments ______

Collector's Name Wayne Pearce Date/Time Sampled 3/19/84

Amount of Sample Collected Quart (solid)

Sample Description Soil 7.5-9 ft BCS

Store at: ☐ Ambient ☐ 5°C ☑ -10°C ☐ Other ______

☐ Caution - No more sample available ☐ Return unused portion of sample ☐ Discard unused portions

Other Instructions - Special Handling - Hazards Unknown Hazard

☐ Hazardous sample (see below) ☐ Non-hazardous sample

☐ Toxic	☐ Skin irritant	☐ Flammable (FP< 40°C)
☐ Pyrophoric	☐ Lachrymator	☐ Shock sensitive
☐ Acidic	☐ Biological	☐ Carcinogenic - suspect
☐ Caustic	☐ Peroxide	☐ Radioactive
☐ Other ______		

Sample Allocation/Chain of Possession:

Organization Name Radian

Received By [illegible] Date Received 3-20-84 Time 8:30

Transported By WP Lab Sample No. 8403203 03

Comments ______

Inclusive Dates of Possession ______

Organization Name ______

Received By ______ Date Received ______ Time ______

Transported By ______ Lab Sample No. ______

Comments ______

Inclusive Dates of Possession ______

Organization Name ______

Received By ______ Date Received ______ Time ______

Transported By ______ Lab Sample No. ______

Comments ______

Inclusive Dates of Possession ______

RADIAN
CORPORATION

CHAIN OF CUSTODY RECORD

Field Sample No. A007

Company Sampled/Address USAF - Bergstrom AFB

Sample Point Description Corehole #1 Motor Pool

Stream Characteristics:

Temperature ______ Flow ______ pH ______

Visual Observations/Comments ______

Collector's Name Wayne Pearce Date/Time Sampled 3/19/84

Amount of Sample Collected Quart (Solid)

Sample Description Soil 15-16.5 ft BCS

Store at: ☐ Ambient ☐ 5°C ☑ -10°C ☐ Other ______

☐ Caution - No more sample available ☐ Return unused portion of sample ☐ Discard unused portions

Other Instructions - Special Handling - Hazards UNKNOWN Hazard

☐ Hazardous sample (see below) ☐ Non-hazardous sample

☐ Toxic ☐ Skin irritant ☐ Flammable (FP< 40°C)
☐ Pyrophoric ☐ Lachrymator ☐ Shock sensitive
☐ Acidic ☐ Biological ☐ Carcinogenic - suspect
☐ Caustic ☐ Peroxide ☐ Radioactive
☐ Other ______

Sample Allocation/Chain of Possession:

Organization Name Radian

Received By [illegible] Date Received 3-20-84 Time 8:30

Transported By WP Lab Sample No. 340320804

Comments ______

Inclusive Dates of Possession ______

Organization Name ______

Received By ______ Date Received ______ Time ______

Transported By ______ Lab Sample No. ______

Comments ______

Inclusive Dates of Possession ______

Organization Name ______

Received By ______ Date Received ______ Time ______

Transported By ______ Lab Sample No. ______

Comments ______

Inclusive Dates of Possession ______

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CORPORATION

CHAIN OF CUSTODY RECORD

Field Sample No. A012

Company Sampled/Address USAF Bergstrom AFB
Sample Point Description Corehole #1 Motor Pool

Stream Characteristics:
Temperature ______ Flow ______ pH ______
Visual Observations/Comments ______

Collector's Name Wayne Pearce Date/Time Sampled 3/19/84
Amount of Sample Collected Quart (Solid)
Sample Description Soil 35-36.5 ft BLS
Store at: ☐ Ambient ☐ 5°C ☑ -10°C ☐ Other ______

☐ Caution - No more sample available ☐ Return unused portion of sample ☐ Discard unused portions
Other Instructions - Special Handling - Hazards Unknown Hazard

☐ Hazardous sample (see below) ☐ Non-hazardous sample

☐ Toxic	☐ Skin irritant	☐ Flammable (FP< 40°C)
☐ Pyrophoric	☐ Lachrymator	☐ Shock sensitive
☐ Acidic	☐ Biological	☐ Carcinogenic - suspect
☐ Caustic	☐ Peroxide	☐ Radioactive
☐ Other ______		

Sample Allocation/Chain of Possession:
Organization Name Radian
Received By [illegible] Date Received 3-20-84 Time 8:30
Transported By WP Lab Sample No. 840320-5-05
Comments ______
Inclusive Dates of Possession ______

Organization Name ______
Received By ______ Date Received ______ Time ______
Transported By ______ Lab Sample No. ______
Comments ______
Inclusive Dates of Possession ______

Organization Name ______
Received By ______ Date Received ______ Time ______
Transported By ______ Lab Sample No. ______
Comments ______
Inclusive Dates of Possession ______

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CORPORATION

CHAIN OF CUSTODY RECORD

Field Sample No. A014

Company Sampled/Address USAF - Bergstrom AFB

Sample Point Description Corehole #1 MotorPool

Stream Characteristics:

Temperature ______ Flow ______ pH ______

Visual Observations/Comments ______

Collector's Name Wayne Pearce Date/Time Sampled 3/19/84

Amount of Sample Collected Quart (Solid)

Sample Description Soil 45-46.5 ft BLS

Store at: ☐ Ambient ☐ 5°C ☑ -10°C ☐ Other ______

☐ Caution - No more sample available ☐ Return unused portion of sample ☐ Discard unused portions

Other Instructions - Special Handling - Hazards Unknown Hazard

☐ Hazardous sample (see below) ☐ Non-hazardous sample

☐ Toxic ☐ Skin irritant ☐ Flammable (FP< 40°C)

☐ Pyrophoric ☐ Lachrymator ☐ Shock sensitive

☐ Acidic ☐ Biological ☐ Carcinogenic - suspect

☐ Caustic ☐ Peroxide ☐ Radioactive

☐ Other ______

Sample Allocation/Chain of Possession:

Organization Name Radian

Received By Jane Lindsey Date Received 3.20.84 Time 3.30

Transported By WP Lab Sample No. 8403208-06

Comments ______

Inclusive Dates of Possession ______

Organization Name ______

Received By ______ Date Received ______ Time ______

Transported By ______ Lab Sample No. ______

Comments ______

Inclusive Dates of Possession ______

Organization Name ______

Received By ______ Date Received ______ Time ______

Transported By ______ Lab Sample No. ______

Comments ______

Inclusive Dates of Possession ______

specific concentration ranges for each analyte. ...
the ratio of the values of A and B are plotted.

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CORPORATION

CHAIN OF CUSTODY RECORD

Field Sample No. A015

Company Sampled/Address USAF - Bergstrom AFB
Sample Point Description Corehole #2 POL

Stream Characteristics:
Temperature ______ Flow ______ pH ______
Visual Observations/Comments ______

Collector's Name Wayne Pearce Date/Time Sampled 3/20/84
Amount of Sample Collected Quart (Solid)
Sample Description Soil 0-1.5ft
Store at: ☐ Ambient ☐ 5°C ☑ -10°C ☐ Other ______

☐ Caution - No more sample available ☐ Return unused portion of sample ☐ Discard unused portions
Other Instructions - Special Handling - Hazards Unknown Hazard

☐ Hazardous sample (see below) ☐ Non-hazardous sample

☐ Toxic
☐ Pyrophoric
☐ Acidic
☐ Caustic
☐ Other ______

☐ Skin irritant
☐ Lachrymator
☐ Biological
☐ Peroxide

☐ Flammable (FP< 40°C)
☐ Shock sensitive
☐ Carcinogenic - suspect
☐ Radioactive

Sample Allocation/Chain of Possession:
Organization Name Radian
Received By [illegible] Date Received 3-21-84 Time 3:30
Transported By UP Lab Sample No. 840321-5-07
Comments ______
Inclusive Dates of Possession ______

Organization Name ______
Received By ______ Date Received ______ Time ______
Transported By ______ Lab Sample No. ______
Comments ______
Inclusive Dates of Possession ______

Organization Name ______
Received By ______ Date Received ______ Time ______
Transported By ______ Lab Sample No. ______
Comments ______
Inclusive Dates of Possession ______

RADIAN
CORPORATION

CHAIN OF CUSTODY RECORD

Field Sample No. A016

Company Sampled/Address USAF Bergstrom AFB

Sample Point Description Corehole #2 POL

Stream Characteristics:

Temperature ______ Flow ______ pH ______

Visual Observations/Comments ______

Collector's Name Wayne Pearce Date/Time Sampled 3/20/84

Amount of Sample Collected Quart (Solid)

Sample Description Soil 2.5-4 ft BLS

Store at: ☐ Ambient ☐ 5°C ☑ -10°C ☐ Other ______

☐ Caution - No more sample available ☐ Return unused portion of sample ☐ Discard unused portions

Other Instructions - Special Handling - Hazards Unknown Hazard

☐ Hazardous sample (see below) ☐ Non-hazardous sample

☐ Toxic ☐ Skin irritant ☐ Flammable (FP< 40°C)
☐ Pyrophoric ☐ Lachrymator ☐ Shock sensitive
☐ Acidic ☐ Biological ☐ Carcinogenic - suspect
☐ Caustic ☐ Peroxide ☐ Radioactive
☐ Other ______

Sample Allocation/Chain of Possession:

Organization Name Radian

Received By [illegible signature] Date Received 3 21 84 Time 5:30

Transported By WP Lab Sample No. [illegible]

Comments ______

Inclusive Dates of Possession ______

Organization Name ______

Received By ______ Date Received ______ Time ______

Transported By ______ Lab Sample No. ______

Comments ______

Inclusive Dates of Possession ______

Organization Name ______

Received By ______ Date Received ______ Time ______

Transported By ______ Lab Sample No. ______

Comments ______

Inclusive Dates of Possession ______

RADIAN
CORPORATION

CHAIN OF CUSTODY RECORD

Field Sample No. A017

Company Sampled/Address USAF Bergstrom AFB

Sample Point Description Corehole #2 POL

Stream Characteristics:

Temperature ______ Flow ______ pH ______

Visual Observations/Comments ______

Collector's Name Wayne Pearce Date/Time Sampled 3/20/84

Amount of Sample Collected Quart (Solid)

Sample Description Soil 5-6.5 ft BLS

Store at: ☐ Ambient ☐ 5°C ☑ -10°C ☐ Other ______

☐ Caution - No more sample available ☐ Return unused portion of sample ☐ Discard unused portions

Other Instructions - Special Handling - Hazards Unknown Hazard

☐ Hazardous sample (see below) ☐ Non-hazardous sample

☐ Toxic ☐ Skin irritant ☐ Flammable (FP< 40°C)
☐ Pyrophoric ☐ Lachrymator ☐ Shock sensitive
☐ Acidic ☐ Biological ☐ Carcinogenic - suspect
☐ Caustic ☐ Peroxide ☐ Radioactive
☐ Other ______

Sample Allocation/Chain of Possession:

Organization Name Radian
Received By [illegible] Date Received 3 21 84 Time 8 30
Transported By WP Lab Sample No. 8403263-09
Comments ______
Inclusive Dates of Possession ______

Organization Name ______
Received By ______ Date Received ______ Time ______
Transported By ______ Lab Sample No. ______
Comments ______
Inclusive Dates of Possession ______

Organization Name ______
Received By ______ Date Received ______ Time ______
Transported By ______ Lab Sample No. ______
Comments ______
Inclusive Dates of Possession ______

RADIAN
CORPORATION

CHAIN OF CUSTODY RECORD

Field Sample No. A019

Company Sampled/Address USAF- Bergstrom AFB

Sample Point Description Corehole #2 POL

Stream Characteristics:

Temperature ______ Flow ______ pH ______

Visual Observations/Comments ______

Collector's Name Wayne Pearce Date/Time Sampled 3/20/84

Amount of Sample Collected Quart (Solid)

Sample Description Soil 10-11.5 ft BLS

Store at: ☐ Ambient ☐ 5°C ☑ −10°C ☐ Other ______

☐ Caution - No more sample available ☐ Return unused portion of sample ☐ Discard unused portions

Other Instructions - Special Handling - Hazards Unknown Hazard

☐ Hazardous sample (see below) ☐ Non-hazardous sample

☐ Toxic	☐ Skin irritant	☐ Flammable (FP< 40°C)
☐ Pyrophoric	☐ Lachrymator	☐ Shock sensitive
☐ Acidic	☐ Biological	☐ Carcinogenic - suspect
☐ Caustic	☐ Peroxide	☐ Radioactive

☐ Other ______

Sample Allocation/Chain of Possession:

Organization Name Radian

Received By [illegible signature] Date Received 3 21 84 Time 3:30

Transported By WP Lab Sample No. 8403208-10

Comments ______

Inclusive Dates of Possession ______

Organization Name ______

Received By ______ Date Received ______ Time ______

Transported By ______ Lab Sample No. ______

Comments ______

Inclusive Dates of Possession ______

Organization Name ______

Received By ______ Date Received ______ Time ______

Transported By ______ Lab Sample No. ______

Comments ______

Inclusive Dates of Possession ______

RADIAN
CORPORATION

CHAIN OF CUSTODY RECORD

Field Sample No. A021

Company Sampled/Address USAF Bergstrom AFB

Sample Point Description Corehole #2 POL

Stream Characteristics:

Temperature ______ Flow ______ pH ______

Visual Observations/Comments ______

Collector's Name Wayne Pearce Date/Time Sampled 3/20/84

Amount of Sample Collected Quart (Solid)

Sample Description Soil 15-16.5 ft BLS

Store at: ☐ Ambient ☐ 5°C ☑ -10°C ☐ Other ______

☐ Caution - No more sample available ☐ Return unused portion of sample ☐ Discard unused portions

Other Instructions - Special Handling - Hazards Unknown Hazard

☐ Hazardous sample (see below) ☐ Non-hazardous sample

☐ Toxic	☐ Skin irritant	☐ Flammable (FP< 40°C)
☐ Pyrophoric	☐ Lachrymator	☐ Shock sensitive
☐ Acidic	☐ Biological	☐ Carcinogenic - suspect
☐ Caustic	☐ Peroxide	☐ Radioactive
☐ Other ______		

Sample Allocation/Chain of Possession:

Organization Name Radian

Received By [illegible] Date Received 3-21-84 Time 8:30

Transported By WP Lab Sample No. 8403-208-11

Comments ______

Inclusive Dates of Possession ______

Organization Name ______

Received By ______ Date Received ______ Time ______

Transported By ______ Lab Sample No. ______

Comments ______

Inclusive Dates of Possession ______

Organization Name ______

Received By ______ Date Received ______ Time ______

Transported By ______ Lab Sample No. ______

Comments ______

Inclusive Dates of Possession ______

RADIAN
CORPORATION

CHAIN OF CUSTODY RECORD

Field Sample No. A023

Company Sampled/Address USAF Bergstrom AFB
Sample Point Description Corehole #2 PC

Stream Characteristics:
Temperature ______ Flow ______ pH ______
Visual Observations/Comments ______

Collector's Name Wayne Pearce Date/Time Sampled 3/20/84
Amount of Sample Collected Quart (Solid)
Sample Description Soil 20-20.9 ft BLS
Store at: ☐ Ambient ☐ 5°C ☑ -10°C ☐ Other ______

☐ Caution - No more sample available ☐ Return unused portion of sample ☐ Discard unused portions
Other Instructions - Special Handling - Hazards Unknown Hazard

☐ Hazardous sample (see below) ☐ Non-hazardous sample

☐ Toxic ☐ Skin irritant ☐ Flammable (FP< 40°C)
☐ Pyrophoric ☐ Lachrymator ☐ Shock sensitive
☐ Acidic ☐ Biological ☐ Carcinogenic - suspect
☐ Caustic ☐ Peroxide ☐ Radioactive
☐ Other ______

Sample Allocation/Chain of Possession:
Organization Name Radian
Received By [illegible] Date Received 3 21 84 Time 3:30
Transported By WP Lab Sample No. 840330-5-12
Comments ______
Inclusive Dates of Possession ______

Organization Name ______
Received By ______ Date Received ______ Time ______
Transported By ______ Lab Sample No. ______
Comments ______
Inclusive Dates of Possession ______

Organization Name ______
Received By ______ Date Received ______ Time ______
Transported By ______ Lab Sample No. ______
Comments ______
Inclusive Dates of Possession ______

RADIAN
CORPORATION

CHAIN OF CUSTODY RECORD

Field Sample No. 4025

Company Sampled/Address USAF Bergstrom AFB

Sample Point Description Corehole #3 Fire Training

Stream Characteristics:

Temperature ______ Flow ______ pH ______

Visual Observations/Comments ______

Collector's Name Wayne Pearce Date/Time Sampled 3/20/84

Amount of Sample Collected Quart (Solid)

Sample Description Soil 0-1.5 ft BLS

Store at: ☐ Ambient ☐ 5°C ☒ -10°C ☐ Other ______

☐ Caution - No more sample available ☐ Return unused portion of sample ☐ Discard unused portions

Other instructions - Special Handling - Hazards Unknown Hazard

☐ Hazardous sample (see below) ☐ Non-hazardous sample

☐ Toxic	☐ Skin irritant	☐ Flammable (FP< 40°C)
☐ Pyrophoric	☐ Lachrymator	☐ Shock sensitive
☐ Acidic	☐ Biological	☐ Carcinogenic - suspect
☐ Caustic	☐ Peroxide	☐ Radioactive

☐ Other ______

Sample Allocation/Chain of Possession:

Organization Name Radian

Received By [illegible signature] Date Received 3-21-84 Time 8:30

Transported By WP Lab Sample No. 403208-13

Comments ______

Inclusive Dates of Possession ______

Organization Name ______

Received By ______ Date Received ______ Time ______

Transported By ______ Lab Sample No. ______

Comments ______

Inclusive Dates of Possession ______

Organization Name ______

Received By ______ Date Received ______ Time ______

Transported By ______ Lab Sample No. ______

Comments ______

Inclusive Dates of Possession ______

RADIAN
CORPORATION

CHAIN OF CUSTODY RECORD

Field Sample No. A026

Company Sampled/Address USAF Bergstrom AFB
Sample Point Description Coreholе #3 Fire Training

Stream Characteristics:
Temperature ______ Flow ______ pH ______
Visual Observations/Comments ______

Collector's Name Wayne Pearce Date/Time Sampled 3/20/84
Amount of Sample Collected Quart (Solid)
Sample Description Soil 2.5-4 ft BLS
Store at: ☐ Ambient ☐ 5°C ☑ −10°C ☐ Other ______

☐ Caution - No more sample available ☐ Return unused portion of sample ☐ Discard unused portions

Other Instructions - Special Handling - Hazards Unknown Hazard

☐ Hazardous sample (see below) ☐ Non-hazardous sample

☐ Toxic	☐ Skin irritant	☐ Flammable (FP< 40°C)
☐ Pyrophoric	☐ Lachrymator	☐ Shock sensitive
☐ Acidic	☐ Biological	☐ Carcinogenic - suspect
☐ Caustic	☐ Peroxide	☐ Radioactive
☐ Other ______		

Sample Allocation/Chain of Possession:
Organization Name Radian
Received By [illegible signature] Date Received 3-21-84 Time 6:30
Transported By WP Lab Sample No. 8403208-14
Comments ______
Inclusive Dates of Possession ______

Organization Name ______
Received By ______ Date Received ______ Time ______
Transported By ______ Lab Sample No. ______
Comments ______
Inclusive Dates of Possession ______

Organization Name ______
Received By ______ Date Received ______ Time ______
Transported By ______ Lab Sample No. ______
Comments ______
Inclusive Dates of Possession ______

RADIAN
CORPORATION

CHAIN OF CUSTODY RECORD

Field Sample No. A028

Company Sampled/Address USAF Bergstrom AFB

Sample Point Description Corehole #3 Fire Training

Stream Characteristics:

Temperature ______ Flow ______ pH ______

Visual Observations/Comments ______

Collector's Name Wayne Pearce Date/Time Sampled 3/20/84

Amount of Sample Collected Quart (Solid)

Sample Description Soil 7.5-9 ft BLS

Store at: ☐ Ambient ☐ 5°C ☒ −10°C ☐ Other ______

☐ Caution · No more sample available ☐ Return unused portion of sample ☐ Discard unused portions

Other Instructions · Special Handling · Hazards Unknown Hazard

☐ Hazardous sample (see below) ☐ Non-hazardous sample

☐ Toxic ☐ Skin irritant ☐ Flammable (FP< 40°C)

☐ Pyrophoric ☐ Lachrymator ☐ Shock sensitive

☐ Acidic ☐ Biological ☐ Carcinogenic · suspect

☐ Caustic ☐ Peroxide ☐ Radioactive

☐ Other ______

Sample Allocation/Chain of Possession:

Organization Name Radian

Received By [signature] Date Received 3-21-84 Time 8 30

Transported By WP Lab Sample No. 8403203-15

Comments ______

Inclusive Dates of Possession ______

Organization Name ______

Received By ______ Date Received ______ Time ______

Transported By ______ Lab Sample No. ______

Comments ______

Inclusive Dates of Possession ______

Organization Name ______

Received By ______ Date Received ______ Time ______

Transported By ______ Lab Sample No. ______

Comments ______

Inclusive Dates of Possession ______

RADIAN
CORPORATION

CHAIN OF CUSTODY RECORD

Field Sample No. A030

Company Sampled/Address USAF Bergstrom AFB
Sample Point Description Corehole #3 Fire Training

Stream Characteristics:
Temperature ____ Flow ____ pH ____
Visual Observations/Comments ____

Collector's Name Wayne Pearce Date/Time Sampled 3/20/84
Amount of Sample Collected Quart (Solid)
Sample Description Soil 12.5-14 ft BGS
Store at: ☐ Ambient ☐ 5°C ☑ -10°C ☐ Other ____

☐ Caution - No more sample available ☐ Return unused portion of sample ☐ Discard unused portions

Other instructions - Special Handling - Hazards Unknown Hazard

☐ Hazardous sample (see below) ☐ Non-hazardous sample

☐ Toxic ☐ Skin irritant ☐ Flammable (FP< 40°C)
☐ Pyrophoric ☐ Lachrymator ☐ Shock sensitive
☐ Acidic ☐ Biological ☐ Carcinogenic - suspect
☐ Caustic ☐ Peroxide ☐ Radioactive
☐ Other ____

Sample Allocation/Chain of Possession:
Organization Name Radian
Received By [illegible] Date Received 3-21-84 Time 3:30
Transported By WP Lab Sample No. 840330-6-16
Comments ____
Inclusive Dates of Possession ____

Organization Name ____
Received By ____ Date Received ____ Time ____
Transported By ____ Lab Sample No. ____
Comments ____
Inclusive Dates of Possession ____

Organization Name ____
Received By ____ Date Received ____ Time ____
Transported By ____ Lab Sample No. ____
Comments ____
Inclusive Dates of Possession ____

RADIAN
CORPORATION

CHAIN OF CUSTODY RECORD

Field Sample No. A032

Company Sampled/Address USAF Bergstrom AFB

Sample Point Description Corehole #3 Fire Training

Stream Characteristics:

Temperature ______ Flow ______ pH ______

Visual Observations/Comments ______

Collector's Name Wayne Pearce Date/Time Sampled 3/20/84

Amount of Sample Collected Quart (Solid)

Sample Description Soil 17.5-19 ft BLS

Store at: ☐ Ambient ☐ 5°C ☐ – 10°C ☐ Other ______

☐ Caution - No more sample available ☐ Return unused portion of sample ☐ Discard unused portions

Other Instructions - Special Handling - Hazards ______

☐ Hazardous sample (see below) ☐ Non hazardous sample

☐ Toxic	☐ Skin irritant	☐ Flammable (FP< 40°C)
☐ Pyrophoric	☐ Lachrymator	☐ Shock sensitive
☐ Acidic	☐ Biological	☐ Carcinogenic - suspect
☐ Caustic	☐ Peroxide	☐ Radioactive
☐ Other ______		

Sample Allocation/Chain of Possession:

Organization Name Radian

Received By [illegible signature] Date Received 3 21 84 Time 4 30

Transported By WP Lab Sample No. 403208-17

Comments ______

Inclusive Dates of Possession ______

Organization Name ______

Received By ______ Date Received ______ Time ______

Transported By ______ Lab Sample No. ______

Comments ______

Inclusive Dates of Possession ______

Organization Name ______

Received By ______ Date Received ______ Time ______

Transported By ______ Lab Sample No. ______

Comments ______

Inclusive Dates of Possession ______

RADIAN
CORPORATION

CHAIN OF CUSTODY RECORD

Field Sample No. A034

Company Sampled/Address USAF - Bergstrom AFB
Sample Point Description Corehole #3 Fire Training

Stream Characteristics:
Temperature ______ Flow ______ pH ______
Visual Observations/Comments ______

Collector's Name Wayne Pearce Date/Time Sampled 3/20/84
Amount of Sample Collected Quart (Solid)
Sample Description Soil 25-26.5 ft BCS
Store at: ☐ Ambient ☐ 5°C ☑ -10°C ☐ Other ______

☐ Caution - No more sample available ☐ Return unused portion of sample ☐ Discard unused portions
Other Instructions - Special Handling - Hazards Unknown Hazard

☐ Hazardous sample (see below) ☐ Non-hazardous sample

☐ Toxic	☐ Skin irritant	☐ Flammable (FP< 40°C)
☐ Pyrophoric	☐ Lachrymator	☐ Shock sensitive
☐ Acidic	☐ Biological	☐ Carcinogenic - suspect
☐ Caustic	☐ Peroxide	☐ Radioactive

☐ Other ______

Sample Allocation/Chain of Possession:
Organization Name Radian
Received By [illegible signature] Date Received 3 31 84 Time 8:30
Transported By WP Lab Sample No. 8403308-18
Comments ______
Inclusive Dates of Possession ______

Organization Name ______
Received By ______ Date Received ______ Time ______
Transported By ______ Lab Sample No. ______
Comments ______
Inclusive Dates of Possession ______

Organization Name ______
Received By ______ Date Received ______ Time ______
Transported By ______ Lab Sample No. ______
Comments ______
Inclusive Dates of Possession ______

RADIAN
CORPORATION

CHAIN OF CUSTODY RECORD

Field Sample No. 4037

Company Sampled/Address USAF - Bergstrom AFB

Sample Point Description Corehole # 4 Fire Training

Stream Characteristics:

Temperature ______ Flow ______ pH ______

Visual Observations/Comments ______

Collector's Name Wayne Pearce Date/Time Sampled 3/21/84

Amount of Sample Collected Quart (solid)

Sample Description Soil 9-11.5 ft BLS

Store at: ☐ Ambient ☐ 5°C ☑ −10°C ☐ Other ______

☐ Caution - No more sample available ☐ Return unused portion of sample ☐ Discard unused portions

Other Instructions - Special Handling - Hazards Unknown Hazard

☐ Hazardous sample (see below) ☐ Non-hazardous sample

☐ Toxic	☐ Skin irritant	☐ Flammable (FP< 40°C)
☐ Pyrophoric	☐ Lachrymator	☐ Shock sensitive
☐ Acidic	☐ Biological	☐ Carcinogenic - suspect
☐ Caustic	☐ Peroxide	☐ Radioactive

☐ Other ______

Sample Allocation/Chain of Possession:

Organization Name Radian

Received By [illegible signature] Date Received 3-22-84 Time 8:30

Transported By WP Lab Sample No. 3403203-19

Comments ______

Inclusive Dates of Possession ______

Organization Name ______

Received By ______ Date Received ______ Time ______

Transported By ______ Lab Sample No. ______

Comments ______

Inclusive Dates of Possession ______

Organization Name ______

Received By ______ Date Received ______ Time ______

Transported By ______ Lab Sample No. ______

Comments ______

Inclusive Dates of Possession ______

RADIAN
CORPORATION

CHAIN OF CUSTODY RECORD

Field Sample No. A038

Company Sampled/Address USAF Bergstrom AFB

Sample Point Description Corehole #4 Fire Training

Stream Characteristics:

Temperature ______ Flow ______ pH ______

Visual Observations/Comments ______

Collector's Name Wayne Pearce Date/Time Sampled 3/21/84

Amount of Sample Collected Quart (Solid)

Sample Description Soil 2.5-4 ft BLS

Store at: ☐ Ambient ☐ 5°C ☑ -10°C ☐ Other ______

☐ Caution · No more sample available ☐ Return unused portion of sample ☐ Discard unused portions

Other Instructions · Special Handling · Hazards Unknown Hazard

☐ Hazardous sample (see below) ☐ Non-hazardous sample

☐ Toxic	☐ Skin irritant	☐ Flammable (FP< 40°C)
☐ Pyrophoric	☐ Lachrymator	☐ Shock sensitive
☐ Acidic	☐ Biological	☐ Carcinogenic · suspect
☐ Caustic	☐ Peroxide	☐ Radioactive
☐ Other ______		

Sample Allocation/Chain of Possession:

Organization Name Radian

Received By [illegible] Date Received 3-22-84 Time 8 30

Transported By WP Lab Sample No. 8403208-20

Comments ______

Inclusive Dates of Possession ______

Organization Name ______

Received By ______ Date Received ______ Time ______

Transported By ______ Lab Sample No. ______

Comments ______

Inclusive Dates of Possession ______

Organization Name ______

Received By ______ Date Received ______ Time ______

Transported By ______ Lab Sample No. ______

Comments ______

Inclusive Dates of Possession ______

RADIAN
CORPORATION

CHAIN OF CUSTODY RECORD

Field Sample No. A040

Company Sampled/Address: USAF Bergstrom AFB

Sample Point Description: Coreholle #4 Firetraining

Stream Characteristics:

Temperature ______ Flow ______ pH ______

Visual Observations/Comments ______

Collector's Name: Wayne Pearce — Date/Time Sampled: 3/21/84

Amount of Sample Collected: Quart (Solid)

Sample Description: Soil 7.5 - 9 ft BLS

Store at: ☐ Ambient ☐ 5°C ☐ -10°C ☐ Other ______

☐ Caution - No more sample available ☐ Return unused portion of sample ☐ Discard unused portions

Other Instructions - Special Handling - Hazards: Unknown Hazard

☐ Hazardous sample (see below) ☐ Non-hazardous sample

☐ Toxic	☐ Skin irritant	☐ Flammable (FP< 40°C)
☐ Pyrophoric	☐ Lachrymator	☐ Shock sensitive
☐ Acidic	☐ Biological	☐ Carcinogenic - suspect
☐ Caustic	☐ Peroxide	☐ Radioactive

Other ______

Sample Allocation/Chain of Possession:

Organization Name: [illegible]
Received By: [illegible] — Date Received: 3 22 84 — Time: [illegible]
Transported By: [illegible] — Lab Sample No. [illegible]
Comments ______
Inclusive Dates of Possession ______

Organization Name ______
Received By ______ Date Received ______ Time ______
Transported By ______ Lab Sample No. ______
Comments ______
Inclusive Dates of Possession ______

Organization Name ______
Received By ______ Date Received ______ Time ______
Transported By ______ Lab Sample No. ______
Comments ______
Inclusive Dates of Possession ______

RADIAN
CORPORATION

CHAIN OF CUSTODY RECORD

Field Sample No. A042

Company Sampled/Address USAF Bergstrom AFB
Sample Point Description Corehole #4 Fire Training

Stream Characteristics:
Temperature ______ Flow ______ pH ______
Visual Observations/Comments ______

Collector's Name Wayne Pearce Date/Time Sampled 3/21/84
Amount of Sample Collected Quart (Solid)
Sample Description Soil 12.5-14 ft BLS
Store at: ☐ Ambient ☐ 5°C ☑ -10°C ☐ Other ______

☐ Caution - No more sample available ☐ Return unused portion of sample ☐ Discard unused portions

Other Instructions - Special Handling - Hazards Unknown Hazard

☐ Hazardous sample (see below) ☐ Non-hazardous sample

☐ Toxic ☐ Skin irritant ☐ Flammable (FP< 40°C)
☐ Pyrophoric ☐ Lachrymator ☐ Shock sensitive
☐ Acidic ☐ Biological ☐ Carcinogenic - suspect
☐ Caustic ☐ Peroxide ☐ Radioactive
☐ Other ______

Sample Allocation/Chain of Possession:
Organization Name Radian
Received By [illegible signature] Date Received 3 22 84 Time 3 30
Transported By WP Lab Sample No. 8403203-22
Comments ______
Inclusive Dates of Possession ______

Organization Name ______
Received By ______ Date Received ______ Time ______
Transported By ______ Lab Sample No. ______
Comments ______
Inclusive Dates of Possession ______

Organization Name ______
Received By ______ Date Received ______ Time ______
Transported By ______ Lab Sample No. ______
Comments ______
Inclusive Dates of Possession ______

RADIAN
CORPORATION

CHAIN OF CUSTODY RECORD

Field Sample No. A044

Company Sampled/Address USAF Bergstrom AFB

Sample Point Description Corehole #4 Fire Training

Stream Characteristics:

Temperature ______ Flow ______ pH ______

Visual Observations/Comments ______

Collector's Name Wayne Pearce Date/Time Sampled 3/21/84

Amount of Sample Collected Quart (Solid)

Sample Description Soil 17.5-19 ft BLS

Store at: ☐ Ambient ☐ 5°C ☑ −10°C ☐ Other ______

☐ Caution · No more sample available ☐ Return unused portion of sample ☐ Discard unused portions

Other Instructions · Special Handling · Hazards Unknown Hazard

☐ Hazardous sample (see below) ☐ Non-hazardous sample

☐ Toxic	☐ Skin irritant	☐ Flammable (FP< 40°C)
☐ Pyrophoric	☐ Lachrymator	☐ Shock sensitive
☐ Acidic	☐ Biological	☐ Carcinogenic · suspect
☐ Caustic	☐ Peroxide	☐ Radioactive
☐ Other ______		

Sample Allocation/Chain of Possession:

Organization Name Radian

Received By [illegible] Date Received 3-22-84 Time 5:30

Transported By UP Lab Sample No. 8403203-23

Comments ______

Inclusive Dates of Possession ______

Organization Name ______

Received By ______ Date Received ______ Time ______

Transported By ______ Lab Sample No. ______

Comments ______

Inclusive Dates of Possession ______

Organization Name ______

Received By ______ Date Received ______ Time ______

Transported By ______ Lab Sample No. ______

Comments ______

Inclusive Dates of Possession ______

RADIAN
CORPORATION

CHAIN OF CUSTODY RECORD

Field Sample No. A046

Company Sampled/Address USAF- Bergstrom

Sample Point Description Corehole #4 Fire Training

Stream Characteristics:

Temperature ______ Flow ______ pH ______

Visual Observations/Comments ______

Collector's Name Wayne Pearce Date/Time Sampled 3/21/84

Amount of Sample Collected Quart (Solid)

Sample Description Soil 25-26.5 ft BLS

Store at: ☐ Ambient ☐ 5°C ☑ 10°C ☐ Other ______

☐ Caution - No more sample available ☐ Return unused portion of sample ☐ Discard unused portions

Other Instructions - Special Handling - Hazards Unknown Hazard

☐ Hazardous sample (see below) ☐ Non-hazardous sample

☐ Toxic	☐ Skin irritant	☐ Flammable (FP< 40°C)
☐ Pyrophoric	☐ Lachrymator	☐ Shock sensitive
☐ Acidic	☐ Biological	☐ Carcinogenic - suspect
☐ Caustic	☐ Peroxide	☐ Radioactive
☐ Other ______		

Sample Allocation/Chain of Possession:

Organization Name Radian

Received By [illegible] Date Received 3 22 84 Time 3 30

Transported By WP Lab Sample No. 8403215-24

Comments ______

Inclusive Dates of Possession ______

Organization Name ______

Received By ______ Date Received ______ Time ______

Transported By ______ Lab Sample No. ______

Comments ______

Inclusive Dates of Possession ______

Organization Name ______

Received By ______ Date Received ______ Time ______

Transported By ______ Lab Sample No. ______

Comments ______

Inclusive Dates of Possession ______

N-7

RADIAN
CORPORATION

CHAIN OF CUSTODY RECORD

Field Sample No.s A052 thru A061

Company Sampled/Address USAF BERGSTROM AFB

Sample Point Description 10 streambed points along South Fork Drainage

Stream Characteristics:

Temperature N/A Flow N/A pH N/A

Visual Observations/Comments —

Collector's Name EW Pearce & R.A. Belan Date/Time Sampled 4/10/84 throut day

Amount of Sample Collected 10 – 1 quart jars

Sample Description Sediment samples

Store at: ☐ Ambient ☐ 5°C ☒ – 10°C ☐ Other

☑ Caution · No more sample available ☐ Return unused portion of sample ☐ Discard unused portions

Other instructions · Special Handling · Hazards Note some samples have lots of water in it.

☐ Hazardous sample (see below) ☐ Non-hazardous sample

☐ Toxic ☐ Skin irritant ☐ Flammable (FP< 40°C)
☐ Pyrophoric ☐ Lachrymator ☐ Shock sensitive
☐ Acidic ☐ Biological ☐ Carcinogenic · suspect
☐ Caustic ☐ Peroxide ☐ Radioactive
☒ Other Unknown

Sample Allocation/Chain of Possession:

Organization Name Radian Analytical Services

Received By [illegible signature] Date Received 4-10-84 Time 16:30

Transported By Rick Belan Lab Sample No. 8404120

Comments

Inclusive Dates of Possession

Organization Name

Received By Date Received Time

Transported By Lab Sample No.

Comments

Inclusive Dates of Possession

Organization Name

Received By Date Received Time

Transported By Lab Sample No.

Comments

Inclusive Dates of Possession

R-29
VSA

RADIAN
CORPORATION

CHAIN OF CUSTODY RECORD

Field Sample No. A062, A063, A064

Company Sampled/Address USAF

Sample Point Description SOUTH FORK DRAINAGE u/c of OIL/WATER SEPARATOR + OUTFALL

Stream Characteristics:

Temperature — Flow — pH —

Visual Observations/Comments

Collector's Name RICK BELAN Date/Time Sampled 4/11/84 last sample at 0904

Amount of Sample Collected 3 - 1 quart jars

Sample Description stream sediment

Store at: ☐ Ambient ☐ 5°C ☒ −10°C ☐ Other

☒ Caution - No more sample available ☐ Return unused portion of sample ☐ Discard unused portions

Other instructions - Special Handling - Hazards SAMPLE A064 had a lot of water in it.

☐ Hazardous sample (see below) ☒ Non-hazardous sample ?

☐ Toxic	☐ Skin irritant	☐ Flammable (FP< 40°C)
☐ Pyrophoric	☐ Lachrymator	☐ Shock sensitive
☐ Acidic	☐ Biological	☐ Carcinogenic - suspect
☐ Caustic	☐ Peroxide	☐ Radioactive

☒ Other unknown

Sample Allocation/Chain of Possession:

Organization Name Radian Analytical Services

Received By [signature] Date Received 4-12-84 Time 8:30

Transported By RB Lab Sample No. 8404120

Comments

Inclusive Dates of Possession

Organization Name

Received By Date Received Time

Transported By Lab Sample No.

Comments

Inclusive Dates of Possession

Organization Name

Received By Date Received Time

Transported By Lab Sample No.

Comments

Inclusive Dates of Possession

RADIAN CORPORATION

CHAIN OF CUSTODY RECORD

FIELD SAMPLE No. A065 + A066

COMPANY SAMPLED/ADDRESS USAF BERGSTROM

SAMPLE POINT DESCRIPTION Monitor Wells 1 + 2

STREAM CHARACTERISTICS: MW-1 MW-2

TEMPERATURE MW-1 (20.5), MW-2 (21.0) FLOW 2.1 gpm; 1 gpm pH 7.38; 7.17

VISUAL OBSERVATIONS/COMMENTS —

COLLECTOR'S NAME R. BELAY DATE/TIME SAMPLED 4/11/84, 1340 + 1524 resp.

AMOUNT OF SAMPLE COLLECTED See other

SAMPLE DESCRIPTION GROUNDWATER

STORE AT: ☐ AMBIENT ☒ 5°C ☐ -10°C ☐ OTHER

☒ CAUTION - NO MORE SAMPLE AVAILABLE ☐ RETURN ALL PORTIONS ☐ RETURN UNUSED PORTION OF SAMPLE

OTHER INSTRUCTIONS - SPECIAL HANDLING - HAZARDS VOA's Taken if needed later

A065: 1 brn glass w/H_2SO_4; 1 brn glass; 1 plastic w/HNO_3; 1 qt + 1 Liter glass clear; 2 VOA

A066: 1 " " " ; 1 " " ; 1 " " ; 1 " + 1 " " " ; 2 VOA

☐ HAZARDOUS SAMPLE (SEE BELOW) ☒ NON-HAZARDOUS SAMPLE ?

☐ TOXIC ☐ SKIN IRRITANT ☐ FLAMMABLE (FP 40°C)

☐ PYROPHORIC ☐ LACHRYMATOR ☐ SHOCK SENSITIVE

☐ ACIDIC ☐ BIOLOGICAL ☐ CARCINOGENIC - SUSPECT

☐ CAUSTIC ☐ PEROXIDE ☐ RADIOACTIVE

☒ OTHER unknown

SAMPLE ALLOCATION / CHAIN OF POSSESSION:

ORGANIZATION NAME Radian

RECEIVED BY [illegible signature] DATE RECEIVED 4-13-84

LAB SAMPLE No. 404119 COMMENTS

INCLUSIVE DATES OF POSSESSION

ORGANIZATION NAME

RECEIVED BY DATE RECEIVED

LAB SAMPLE No. COMMENTS

INCLUSIVE DATES OF POSSESSION

ORGANIZATION NAME

RECEIVED BY DATE RECEIVED

LAB SAMPLE No. COMMENTS

INCLUSIVE DATES OF POSSESSION

RADIAN
CORPORATION

R29

CHAIN OF CUSTODY RECORD

Field Sample No. 5 A067, A068, A069, A070

Company Sampled/Address USAF BERGSTROM

Sample Point Description Monitor Wells #3, 4, 5 + 6 (A067)(A070)(A069) (A068)

Stream Characteristics:

Temperature A067 22 / A068 23 / A069 22 / A070 24.5 Flow 1.2 gpm / 1.2 / – / – pH 6.86/6.72/6.54/6.66

Visual Observations/Comments –

Collector's Name R. BELAN Date/Time Sampled 4/12/84; 1212/1344/1504/~~1034~~/...

Amount of Sample Collected SEE OTHER

Sample Description SEE OTHER

Store at: ☐ Ambient ☒ 5°C ☐ −10°C ☐ Other

☐ Caution · No more sample available ☐ Return unused portion of sample ☐ Discard unused portions

Other Instructions · Special Handling · Hazards EACH SAMPLE NUMBER CONSISTS of 5 sample bottles as follows: 1 brown glass jar-500ml w/H_2SO_4, 1 brown glass jar, 1 500ml plastic w/HNO_3, 1 Liter glass clear (small mouth), 1 qt clear glass (wide...

☐ Hazardous sample (see below) ☒ Non-hazardous sample ?

☐ Toxic	☐ Skin irritant	☐ Flammable (FP< 40°C)
☐ Pyrophoric	☐ Lachrymator	☐ Shock sensitive
☐ Acidic	☐ Biological	☐ Carcinogenic · suspect
☐ Caustic	☐ Peroxide	☐ Radioactive

☒ Other UNKNOWN

Sample Allocation/Chain of Possession:

Organization Name EAS

Received By [signature] Date Received 4/13/84 Time 9:00

Transported By Hand Lab Sample No. 84C419

Comments

Inclusive Dates of Possession

Organization Name

Received By Date Received Time

Transported By Lab Sample No.

Comments

Inclusive Dates of Possession

Organization Name

Received By Date Received Time

Transported By Lab Sample No.

Comments

Inclusive Dates of Possession

RADIAN
CORPORATION

CHAIN OF CUSTODY RECORD

Field Sample No. 4071 - A073

Company Sampled/Address USAF - Bergstrom
Sample Point Description Oil Spreading Area

Stream Characteristics:
Temperature ______ Flow ______ pH ______
Visual Observations/Comments ______

Collector's Name W Pierce / R Bell Date/Time Sampled 4/16/84
Amount of Sample Collected Grab (Solid)
Sample Description ______
Store at: ☐ Ambient ☐ 5°C ☑ -10°C ☐ Other ______

☐ Caution - No more sample available ☐ Return unused portion of sample ☐ Discard unused portions
Other Instructions - Special Handling - Hazards Possible PCB's

☐ Hazardous sample (see below) ☐ Non-hazardous sample

☐ Toxic ☐ Skin irritant ☐ Flammable (FP< 40°C)
☐ Pyrophoric ☐ Lachrymator ☐ Shock sensitive
☐ Acidic ☐ Biological ☐ Carcinogenic - suspect
☐ Caustic ☐ Peroxide ☐ Radioactive
☐ Other ______

Sample Allocation/Chain of Possession:
Organization Name Radian
Received By [illegible] Date Received 4-16-84 Time 16 15
Transported By EWP Lab Sample No. 544116
Comments ______
Inclusive Dates of Possession ______

Organization Name ______
Received By ______ Date Received ______ Time ______
Transported By ______ Lab Sample No. ______
Comments ______
Inclusive Dates of Possession ______

Organization Name ______
Received By ______ Date Received ______ Time ______
Transported By ______ Lab Sample No. ______
Comments ______
Inclusive Dates of Possession ______

RADIAN
CORPORATION

CHAIN OF CUSTODY RECORD

Field Sample No. A 074 { A B C D E

Company Sampled/Address USAF Bergstrom
Sample Point Description MW-1

Stream Characteristics:
Temperature ______ Flow ______ pH ______
Visual Observations/Comments ______

Collector's Name Wayne Pearce Date/Time Sampled 5/10/84
Amount of Sample Collected 5 units totaling ~3.5 liters
Sample Description Ground Water
Store at: ☐ Ambient ☑ 5°C ☐ −10°C ☐ Other ______

☐ Caution - No more sample available ☐ Return unused portion of sample ☐ Discard unused portions

Other Instructions - Special Handling - Hazards Unknown Hazard

☐ Hazardous sample (see below) ☐ Non-hazardous sample

☐ Toxic	☐ Skin irritant	☐ Flammable (FP< 40°C)
☐ Pyrophoric	☐ Lachrymator	☐ Shock sensitive
☐ Acidic	☐ Biological	☐ Carcinogenic - suspect
☐ Caustic	☐ Peroxide	☐ Radioactive
☐ Other		

Sample Allocation/Chain of Possession:

Organization Name RAS
Received By [signature] Date Received 5-10-84 Time 10:30
Transported By EWP Lab Sample No. 8405059-01
Comments ______
Inclusive Dates of Possession ______

Organization Name ______
Received By ______ Date Received ______ Time ______
Transported By ______ Lab Sample No. ______
Comments ______
Inclusive Dates of Possession ______

Organization Name ______
Received By ______ Date Received ______ Time ______
Transported By ______ Lab Sample No. ______
Comments ______
Inclusive Dates of Possession ______

RADIAN
CORPORATION

CHAIN OF CUSTODY RECORD

Field Sample No. A075 {A B C D E

Company Sampled/Address USAF Bergstrom

Sample Point Description ~~[illegible]~~ Golf Course Well

Stream Characteristics:

Temperature ______ Flow ______ pH ______

Visual Observations/Comments ______

Collector's Name Wayne Pearce Date/Time Sampled 5/10/84

Amount of Sample Collected 5 units totaling ~3.5 liters

Sample Description Ground Water

Store at: ☐ Ambient ☑ 5°C ☐ -10°C ☐ Other ______

☐ Caution - No more sample available ☐ Return unused portion of sample ☐ Discard unused portions

Other Instructions - Special Handling - Hazards Unknown Hazard

☐ Hazardous sample (see below) ☐ Non-hazardous sample

☐ Toxic ☐ Skin irritant ☐ Flammable (FP< 40°C)

☐ Pyrophoric ☐ Lachrymator ☐ Shock sensitive

☐ Acidic ☐ Biological ☐ Carcinogenic - suspect

☐ Caustic ☐ Peroxide ☐ Radioactive

☐ Other ______

Sample Allocation/Chain of Possession:

Organization Name RAS

Received By [illegible] Date Received 5-10-84 Time 16:30

Transported By EWP Lab Sample No. 8405051 02

Comments ______

Inclusive Dates of Possession ______

Organization Name ______

Received By ______ Date Received ______ Time ______

Transported By ______ Lab Sample No. ______

Comments ______

Inclusive Dates of Possession ______

Organization Name ______

Received By ______ Date Received ______ Time ______

Transported By ______ Lab Sample No. ______

Comments ______

Inclusive Dates of Possession ______

RADIAN
CORPORATION

CHAIN OF CUSTODY RECORD

Field Sample No. A076 {A B C D E}

Company Sampled/Address USAF Bergstrom
Sample Point Description Monitor Well - 2

Stream Characteristics:
Temperature ______ Flow ______ pH ______
Visual Observations/Comments ______

Collector's Name Wayne Pearce Date/Time Sampled 5/10/84
Amount of Sample Collected 5 units totaling ~ 3.5 liters
Sample Description Ground Water
Store at: ☐ Ambient ☑ 5°C ☐ −10°C ☐ Other ______

☐ Caution - No more sample available ☐ Return unused portion of sample ☐ Discard unused portions

Other Instructions - Special Handling - Hazards Unknown Hazard

☐ Hazardous sample (see below) ☐ Non-hazardous sample

☐ Toxic ☐ Skin irritant ☐ Flammable (FP< 40°C)
☐ Pyrophoric ☐ Lachrymator ☐ Shock sensitive
☐ Acidic ☐ Biological ☐ Carcinogenic - suspect
☐ Caustic ☐ Peroxide ☐ Radioactive
☐ Other ______

Sample Allocation/Chain of Possession:
Organization Name RAS
Received By [illegible] Date Received 5-10-84 Time 10:30
Transported By EWP Lab Sample No. 8405051-03
Comments ______
Inclusive Dates of Possession ______

Organization Name ______
Received By ______ Date Received ______ Time ______
Transported By ______ Lab Sample No. ______
Comments ______
Inclusive Dates of Possession ______

Organization Name ______
Received By ______ Date Received ______ Time ______
Transported By ______ Lab Sample No. ______
Comments ______
Inclusive Dates of Possession ______

RADIAN
CORPORATION

CHAIN OF CUSTODY RECORD

Field Sample No. A077 {A B C D E

Company Sampled/Address USAF Bergstrom

Sample Point Description Monitor Well 3

Stream Characteristics:

Temperature ______ **Flow** ______ **pH** ______

Visual Observations/Comments ______

Collector's Name Wayne Pearce **Date/Time Sampled** 5/10/84

Amount of Sample Collected 5 units totaling ~ 3.5 liters

Sample Description Ground Water

Store at: ☐ Ambient ☑ 5°C ☐ −10°C ☐ Other ______

☐ Caution - No more sample available ☐ Return unused portion of sample ☐ Discard unused portions

Other Instructions - Special Handling - Hazards Unknown Hazard

☐ Hazardous sample (see below) ☐ Non-hazardous sample

☐ Toxic ☐ Skin irritant ☐ Flammable (FP< 40°C)
☐ Pyrophoric ☐ Lachrymator ☐ Shock sensitive
☐ Acidic ☐ Biological ☐ Carcinogenic - suspect
☐ Caustic ☐ Peroxide ☐ Radioactive
☐ Other ______

Sample Allocation/Chain of Possession:

Organization Name RAS

Received By [illegible signature] **Date Received** 5-10-84 **Time** 10:30

Transported By EWP **Lab Sample No.** 8405059 04

Comments ______

Inclusive Dates of Possession ______

Organization Name ______

Received By ______ **Date Received** ______ **Time** ______

Transported By ______ **Lab Sample No.** ______

Comments ______

Inclusive Dates of Possession ______

Organization Name ______

Received By ______ **Date Received** ______ **Time** ______

Transported By ______ **Lab Sample No.** ______

Comments ______

Inclusive Dates of Possession ______

RADIAN
CORPORATION

CHAIN OF CUSTODY RECORD

Field Sample No. A078 {A B C D E

Company Sampled/Address USAF Bergstrom

Sample Point Description Monitor Well 6

Stream Characteristics:

Temperature ______ Flow ______ pH ______

Visual Observations/Comments ______

Collector's Name Wayne Pearce Date/Time Sampled 5/10/84

Amount of Sample Collected 5 units totalling ~3.5 liters

Sample Description Ground Water

Store at: ☐ Ambient ☑ 5°C ☐ −10°C ☐ Other ______

☐ Caution · No more sample available ☐ Return unused portion of sample ☐ Discard unused portions

Other Instructions · Special Handling · Hazards Unknown Hazard

☐ Hazardous sample (see below) ☐ Non-hazardous sample

☐ Toxic	☐ Skin irritant	☐ Flammable (FP< 40°C)
☐ Pyrophoric	☐ Lachrymator	☐ Shock sensitive
☐ Acidic	☐ Biological	☐ Carcinogenic · suspect
☐ Caustic	☐ Peroxide	☐ Radioactive
☐ Other ______		

Sample Allocation/Chain of Possession:

Organization Name RAS

Received By [illegible] Date Received 5-10-84 Time 10:30

Transported By EWP Lab Sample No. 8405059-05

Comments ______

Inclusive Dates of Possession ______

Organization Name ______

Received By ______ Date Received ______ Time ______

Transported By ______ Lab Sample No. ______

Comments ______

Inclusive Dates of Possession ______

Organization Name ______

Received By ______ Date Received ______ Time ______

Transported By ______ Lab Sample No. ______

Comments ______

Inclusive Dates of Possession ______

RADIAN CORPORATION

CHAIN OF CUSTODY RECORD

Field Sample No. A079 {A B C D E

Company Sampled/Address USAF Bergstrom

Sample Point Description Monitor Well - 4

Stream Characteristics:

Temperature ______ Flow ______ pH ______

Visual Observations/Comments ______

Collector's Name Rick Belan Date/Time Sampled 5/11/84

Amount of Sample Collected 5 units totaling ~3.5 liters

Sample Description Ground water

Store at: ☐ Ambient ☑ 5°C ☐ −10°C ☐ Other ______

☐ Caution · No more sample available ☐ Return unused portion of sample ☐ Discard unused portions

Other Instructions · Special Handling · Hazards Unknown Hazard

☐ Hazardous sample (see below) ☐ Non-hazardous sample

☐ Toxic	☐ Skin Irritant	☐ Flammable (FP< 40°C)
☐ Pyrophoric	☐ Lachrymator	☐ Shock sensitive
☐ Acidic	☐ Biological	☐ Carcinogenic · suspect
☐ Caustic	☐ Peroxide	☐ Radioactive

☐ Other ______

Sample Allocation/Chain of Possession:

Organization Name RAS

Received By [signature] Date Received 5-11-84 Time 13.30

Transported By RB Lab Sample No. 8405059-06

Comments ______

Inclusive Dates of Possession ______

Organization Name ______

Received By ______ Date Received ______ Time ______

Transported By ______ Lab Sample No. ______

Comments ______

Inclusive Dates of Possession ______

Organization Name ______

Received By ______ Date Received ______ Time ______

Transported By ______ Lab Sample No. ______

Comments ______

Inclusive Dates of Possession ______

RADIAN
CORPORATION

CHAIN OF CUSTODY RECORD

Field Sample No. A080 {A B C D E

Company Sampled/Address USAF Bergstrom

Sample Point Description Monitor Well - 5

Stream Characteristics:

Temperature ______ Flow ______ pH ______

Visual Observations/Comments ______

Collector's Name Rich Belan Date/Time Sampled 5/11/84

Amount of Sample Collected 5 units totaling ~ 3.5 liters

Sample Description Ground Water

Store at: ☐ Ambient ☑ 5°C ☐ -10°C ☐ Other ______

☐ Caution · No more sample available ☐ Return unused portion of sample ☐ Discard unused portions

Other Instructions · Special Handling · Hazards Unknown Hazard.

☐ Hazardous sample (see below) ☐ Non-hazardous sample

☐ Toxic	☐ Skin irritant	☐ Flammable (FP< 40°C)
☐ Pyrophoric	☐ Lachrymator	☐ Shock sensitive
☐ Acidic	☐ Biological	☐ Carcinogenic · suspect
☐ Caustic	☐ Peroxide	☐ Radioactive
☐ Other ______		

Sample Allocation/Chain of Possession:

Organization Name RAS

Received By [signature] Date Received 5-11-84 Time 13.30

Transported By RB Lab Sample No. 8405051-07

Comments ______

Inclusive Dates of Possession ______

Organization Name ______

Received By ______ Date Received ______ Time ______

Transported By ______ Lab Sample No. ______

Comments ______

Inclusive Dates of Possession ______

Organization Name ______

Received By ______ Date Received ______ Time ______

Transported By ______ Lab Sample No. ______

Comments ______

Inclusive Dates of Possession ______

RADIAN
CORPORATION

CHAIN OF CUSTODY RECORD

A081 thru

Field Sample No. A100

Company Sampled/Address USAF OEHL (BERGSTROM)
Sample Point Description SITE #9 (JP-4 FUEL PIPELINE)
Stream Characteristics: N/A
Temperature ______ Flow ______ pH ______
Visual Observations/Comments ______

Collector's Name PETER A WATERREUS Date/Time Sampled 2/20/85 → 2/21/85
Amount of Sample Collected 2 VOAS FOR EACH SAMPLE NUMBER
Sample Description SOIL
Store at: ☐ Ambient ☐ 5°C ☐ −10°C ☒ Other 4°C

☒ Caution - No more sample available ☐ Return unused portion of sample ☐ Discard unused portions

Other Instructions - Special Handling - Hazards ______

☐ Hazardous sample (see below) ☐ Non-hazardous sample

☐ Toxic ☐ Skin irritant ☐ Flammable (FP< 40°C)
☐ Pyrophoric ☐ Lachrymator ☐ Shock sensitive
☐ Acidic ☐ Biological ☐ Carcinogenic - suspect
☐ Caustic ☐ Peroxide ☐ Radioactive
☒ Other SUSPECTED CONTAMINATED BY HYDROCARBONS

Sample Allocation/Chain of Possession:
Organization Name RAS
Received By [signature] Date Received 2-22-85 Time 1100
Transported By PAW Lab Sample No. 8502155
Comments ______
Inclusive Dates of Possession ______

Organization Name ______
Received By ______ Date Received ______ Time ______
Transported By ______ Lab Sample No. ______
Comments ______
Inclusive Dates of Possession ______

Organization Name ______
Received By ______ Date Received ______ Time ______
Transported By ______ Lab Sample No. ______
Comments ______
Inclusive Dates of Possession ______

RADIAN
CORPORATION

CHAIN OF CUSTODY RECORD

A103
Field Sample No. A104

Company Sampled/Address USAF BERGSTROM
Sample Point Description MW-2, MW-3
Stream Characteristics: N/A
Temperature ______ Flow ______ pH ______
Visual Observations/Comments ______

Collector's Name PAW
Date/Time Sampled 2/25/85 11:55, 12:30
Amount of Sample Collected 2 VOAS for each sample number
Sample Description WATER
Store at: ☐ Ambient ☐ 5°C ☐ −10°C ☒ Other 4°C

☐ Caution - No more sample available ☒ Return unused portion of sample ☐ Discard unused portions

Other Instructions - Special Handling - Hazards PLEASE RETURN UNUSED VOA TO PETER WATERBERS or RICK BELAN

☐ Hazardous sample (see below) ☐ Non-hazardous sample

☐ Toxic	☐ Skin irritant	☐ Flammable (FP< 40°C)
☐ Pyrophoric	☐ Lachrymator	☐ Shock sensitive
☐ Acidic	☐ Biological	☐ Carcinogenic - suspect
☐ Caustic	☐ Peroxide	☐ Radioactive

☐ Other MAY CONTAIN HYDROCARBONS

Sample Allocation/Chain of Possession:
Organization Name RAS
Received By [signature] Date Received 2-26-85 Time 0830
Transported By PAW Lab Sample No. 4502172
Comments ______
Inclusive Dates of Possession ______

Organization Name ______
Received By ______ Date Received ______ Time ______
Transported By ______ Lab Sample No. ______
Comments ______
Inclusive Dates of Possession ______

Organization Name ______
Received By ______ Date Received ______ Time ______
Transported By ______ Lab Sample No. ______
Comments ______
Inclusive Dates of Possession ______

RADIAN
CORPORATION

CHAIN OF CUSTODY RECORD

Field Sample No. A102

Company Sampled/Address USAF BERGSTROM

Sample Point Description LOW DRAIN JP-4 FUEL PIPELINE VALVE

Stream Characteristics: N/A

Temperature ______ Flow ______ pH ______

Visual Observations/Comments ______

Collector's Name BAB Date/Time Sampled ______

Amount of Sample Collected 1 VOA

Sample Description JP-4 FUEL

Store at: ☐ Ambient ☐ 5°C ☐ −10°C ☐ Other ______

☐ Caution - No more sample available ☒ Return unused portion of sample ☐ Discard unused portions

Other instructions - Special Handling - Hazards CAUTION (PURE FUEL) ADJUST INSTRUMENTATION ACCORDINGLY. IF ANY QUESTIONS CALL RICK BELAN OR PETE WATERREUS

☒ Hazardous sample (see below) ☐ Non-hazardous sample

☐ Toxic ☐ Skin irritant ☒ Flammable (FP< 40°C)

☐ Pyrophoric ☐ Lachrymator ☐ Shock sensitive

☐ Acidic ☐ Biological ☐ Carcinogenic - suspect

☐ Caustic ☐ Peroxide ☐ Radioactive

☒ Other JP-4 FUEL

Sample Allocation/Chain of Possession:

Organization Name RAS

Received By [illegible signature] Date Received 2-26-85 Time 0830

Transported By PAW Lab Sample No. 4502172

Comments ______

Inclusive Dates of Possession ______

Organization Name ______

Received By ______ Date Received ______ Time ______

Transported By ______ Lab Sample No. ______

Comments ______

Inclusive Dates of Possession ______

Organization Name ______

Received By ______ Date Received ______ Time ______

Transported By ______ Lab Sample No. ______

Comments ______

Inclusive Dates of Possession ______

GAS CANISTER
CHAIN OF CUSTODY

LOCATION: HS-1 Bergstrom CODE #: A107

DATE: 2/25/85 TYPE: 1
(1=ambient, 2=blank, 3=duplicate)

CANISTER #: 111

CUSTODY RECORD

Operation	Date	Initials	Comments
1) Canister Cleaned	2-20-85	JSW	
2) Canister Evacuated	2-20-85	JSW	VAC: -13.39
3) Filter Cleaned			
4) Canister & Filter received at site			
5) Canister & Filter shipped to Austin			
6) Canister & Filter received in Austin			
7) Analysis Completed	3-12-85	ARG	

Sampling Personnel: ~~[illegible]~~ PAW

Sampling Time: ~~[illegible]~~

Sampling Position: ~~[illegible]~~

	DILUTION #1	DILUTION #2	DILUTION #3	DILUTION #4
Pressure: Initial:	-13.39			
Final:	-1.11			
add UHP air:	22.81			
Dilution Factor:	.3274			
Final Dilution Factor:	.3274			

$$\frac{12.28}{22.81+14.7}$$

Comments:

GAS CANISTER
CHAIN OF CUSTODY

LOCATION: MW-1, Brighton CODE #: A101

DATE: 2/25/85 TYPE: 1
(1=ambient, 2=blank, 3=duplicate)

CANISTER #: 155

CUSTODY RECORD

Operation	Date	Initials	Comments
1) Canister Cleaned	2-20-85	JSW	
2) Canister Evacuated	2-20-85	JSW	VAC: -13.38
3) Filter Cleaned			
4) Canister & Filter received at site			
5) Canister & Filter shipped to Austin			
6) Canister & Filter received in Austin			
7) Analysis Completed	3-13-85	JLD	

Sampling Personnel: RAW

Sampling Time:

Sampling Position:

	DILUTION #1	DILUTION #2	DILUTION #3	DILUTION #4
Pressure: Initial:	-13.38			
Final:	-2.41			
add UHP air:	23.39			

Dilution Factor: .2880

Final Dilution Factor: .2880

$$\frac{10.97}{23.39 + 14.7}$$

Comments:

GAS CANISTER
CHAIN OF CUSTODY

LOCATION: HS-3 CODE #: A105

DATE: 2/25/85 TYPE: 1 (1=ambient, 2=blank, 3=duplicate)

CANISTER #: 135

CUSTODY RECORD

Operation	Date	Initials	Comments
1) Canister Cleaned	2-20-85	JSW	
2) Canister Evacuated	2-20-85	JSW	VAC: -13.38
3) Filter Cleaned			
4) Canister & Filter received at site			
5) Canister & Filter shipped to Austin			
6) Canister & Filter received in Austin			
7) Analysis Completed	3-12-85	JLU	

Sampling Personnel: PAW

Sampling Time:

Sampling Position:

	DILUTION #1	DILUTION #2	DILUTION #3	DILUTION #4
Pressure: Initial:	-13.38			
Final:	-2.00			
add UHP air:	+23.20			

Dilution Factor: .3003

$$\frac{11.38}{23.20 + 14.7}$$

Final Dilution Factor: .3003

Comments:

GAS CANISTER
CHAIN OF CUSTODY

LOCATION: #S-4 Bergstrom CODE #: A106

DATE: 2/25/85 TYPE: 1
(1=ambient, 2=blank, 3=duplicate)

CANISTER #: 114

CUSTODY RECORD

Operation	Date	Initials	Comments
1) Canister Cleaned	2-20-85	JSW	
2) Canister Evacuated	2-20-85	JSW	VAC: -13.38
3) Filter Cleaned			
4) Canister & Filter received at site			
5) Canister & Filter shipped to Austin			
6) Canister & Filter received in Austin			
7) Analysis Completed	3-13-85	JLO	

Sampling Personnel: PAW

Sampling Time: ________

Sampling Position: ________

	DILUTION #1	DILUTION #2	DILUTION #3	DILUTION #4
Pressure: Initial:	-13.38			
Final:	0			
add UHP air:	+23.05			

Dilution Factor: .3544

Final Dilution Factor: .3544

$$\frac{13.38}{23.05 + 14.7}$$

Comments: ________

RADIAN CORPORATION

APPENDIX H

ANALYTICAL DATA

RADIAN CORPORATION

RECEIVED: 03/21/84

Analytical Serv REPORT

05/09/84 08:35:15

LAB # 84-03-205

REPORT TO	Radian Bl. 4 Austin
ATTEN	Wayne Pearce
CLIENT	BERGSTROM
SAMPLES	4
COMPANY	Bergstrom AFB
FACILITY	
WORK ID	water samples
TAKEN	Pearce
TRANS	hand
TYPE	
P.O. #	212-027-11-05
INVOICE	under separate cover

PREPARED BY	Radian Analytical Services 8501 MoPac Blvd P.O. Box 9948 Austin, Texas 78766
ATTEN	
PHONE	(512) 454-4797

CERTIFIED BY

CONTACT CONOVER

Note: second column confirmation performed for EPA Method 602.

SAMPLE IDENTIFICATION

01	A036
02	A048
03	A049
04	A051

Analytical Serv TEST CODES and NAMES used on this report

CD E	Cadmium, ICPES
CR E	Chromium, ICPES
GC 601	EPA Method 601/GC
GC 602	EPA Method 602/GC
NI E	Nickel, ICPES
ONG IR	Oil and Grease, Infrared
PB GA	Lead, low level
TOC	Total Organic Carbon

RADIAN CORPORATION

RECEIVED: 03/21/84

Analytical Serv REPORT
RESULTS BY TEST

LAB # 84-03-205

TEST CODE default units	Sample 01 (entered units)	Sample 02 (entered units)	Sample 03 (entered units)	Sample 04 (entered units)
CD_E ug/ml	0.004	<.002	<.002	<.002
CR_E ug/ml	0.065	0.002	<.001	<.001
NI_E ug/ml	0.26	0.076	<.003	0.006
ONG_IR mg/L	20	43	<1	6
PB_GA ug/ml	1.5	0.090	0.190	0.030
TOC mg/L	38	40	4	2

RADIAN CORPORATION

RECEIVED: 03/21/84 | Analytical Serv REPORT | LAB # 84-03-205

Results by Sample

SAMPLE ID A036 FRACTION 01C TEST CODE GC 602 NAME EPA Method 602/GC

Date & Time Collected not specified Category

DATA FILE D DATE INJECTED 04/05/84 ANALYST MCL VERIFIED BY JSG

CONC. FACTOR INSTRUMENT d COMPOUNDS DETECTED 2

SCAN	COMPOUND	RESULT	SCAN	COMPOUND	RESULT
1	Benzene	1040		1,3-Dichlorobenzene	ND
	Toluene	ND		1,2-Dichlorobenzene	ND
2	Ethyl Benzene	303		1,4-Dichlorobenzene	ND

NOTES AND DEFINITIONS FOR THIS REPORT.

SCAN = scan number or retention time on chromatogram.

All results reported in ug/L unless otherwise specified.

ND = not detected at EPA detection limit method 602, (Federal Register, 12/3/79).

RADIAN CORPORATION

PAGE 4 Analytical Serv REPORT LAB # 84-03-205
RECEIVED: 03/21/84 Results by Sample

SAMPLE ID A048 FRACTION 02D TEST CODE GC 601 NAME EPA Method 601/GC
Date & Time Collected not specified Category

DATA FILE B DATE INJECTED 04/05/84 ANALYST MCL VERIFIED BY JSG
CONC. FACTOR INSTRUMENT b COMPOUNDS DETECTED 3

SCAN	COMPOUND	RESULT	SCAN	COMPOUND	RESULT
	Chloromethane	ND	3	Trichloroethene	0.8
	Bromomethane	ND		Dibromochloromethane *	ND
	Vinyl Chloride	ND		1,1,2-Trichloroethane *	ND
	Chloroethane	ND		cis-1,3-Dichloropropene *	ND
	Methylene Chloride	ND		2-Chloroethylvinyl Ether	ND
1	Trichlorofluoromethane	2.3		Bromoform	ND
	1,1-Dichloroethene	ND		1,1,2,2-Tetrachloroethane #	ND
	1,1-Dichloroethane	ND		Tetrachloroethylene #	ND
2	trans-1,2-Dichloroethene	42.6		Chlorobenzene	ND
	Chloroform	ND		1,3-Dichlorobenzene	ND
	1,2-Dichloroethane	ND		1,2-Dichlorobenzene	ND
	1,1,1-Trichloroethane	ND		1,4-Dichlorobenzene	ND
	Carbon Tetrachloride	ND			
	Bromodichloromethane	ND			
	1,2-Dichloropropane	ND			
	trans-1,3-Dichloropropene	ND			

RADIAN
CORPORATION

RECEIVED: 03/21/84

Analytical Serv REPORT
Results by Sample

LAB # 84-03-205
Continued From Above

SAMPLE ID A048

FRACTION 02D TEST CODE GC 601 NAME EPA Method 601/GC
Date & Time Collected not specified Category

NOTES AND DEFINITIONS FOR THIS REPORT.

SCAN = scan number or retention time on chromatogram.
All results reported in ug/L unless otherwise specified.
ND = not detected at EPA detection limit method 601, (Federal Register, 12/3/79).
*Dibromochloromethane, 1,1,2-trichloroethane and cis-1,3-dichloropropene co-elute.
#1,1,2,2-tetrachloroethane and tetrachloroethylene co-elute

RADIAN CORPORATION

PAGE 6
RECEIVED: 03/21/84

Analytical Serv REPORT
Results by Sample

LAB # 84-03-205

SAMPLE ID A048

FRACTION 02C TEST CODE GC 602 NAME EPA Method 602/GC
Date & Time Collected not specified Category

DATA FILE D
CONC. FACTOR

DATE INJECTED 04/05/84

ANALYST MCL
INSTRUMENT d

VERIFIED BY JSG
COMPOUNDS DETECTED 2

SCAN	COMPOUND	RESULT	SCAN	COMPOUND	RESULT
1	Benzene	196		1,3-Dichlorobenzene	ND
	Toluene	ND		1,2-Dichlorobenzene	ND
2	Ethyl Benzene	440		1,4-Dichlorobenzene	ND

NOTES AND DEFINITIONS FOR THIS REPORT.
SCAN = scan number or retention time on chromatogram.
All results reported in ug/L unless otherwise specified
ND = not detected at EPA detection limit method 602, (Federal Register, 12/3/79).

RADIAN CORPORATION

RECEIVED: 03/21/84

Analytical Serv REPORT
Results by Sample

LAB # 84-03-205

SAMPLE ID A049

FRACTION 03C TEST CODE GC 602 NAME EPA Method 602/GC
Date & Time Collected not specified Category

DATA FILE D
CONC. FACTOR

DATE INJECTED 04/05/84

ANALYST MCL
INSTRUMENT d

VERIFIED BY JSG
COMPOUNDS DETECTED 0

SCAN	COMPOUND	RESULT	SCAN	COMPOUND	RESULT
	Benzene	ND		1,3-Dichlorobenzene	ND
	Toluene	ND		1,2-Dichlorobenzene	ND
	Ethyl Benzene	ND		1,4-Dichlorobenzene	ND

NOTES AND DEFINITIONS FOR THIS REPORT.
SCAN = scan number or retention time on chromatogram.
All results reported in ug/L unless otherwise specified
ND = not detected at EPA detection limit method 602, (Federal Register, 12/3/79).

RADIAN CORPORATION

PAGE 8 Analytical Serv REPORT LAB # 84-03-205
RECEIVED: 03/21/84 Results by Sample

SAMPLE ID A051 FRACTION 04D TEST CODE GC 601 NAME EPA Method 601/GC
Date & Time Collected not specified Category

DATA FILE B DATE INJECTED 04/05/84 ANALYST MCL VERIFIED BY JSG
CONC. FACTOR INSTRUMENT b COMPOUNDS DETECTED 2

SCAN	COMPOUND	RESULT	SCAN	COMPOUND	RESULT
	Chloromethane	ND		Trichloroethene	ND
	Bromomethane	ND		Dibromochloromethane *	ND
	Vinyl Chloride	ND		1,1,2-Trichloroethane *	ND
	Chloroethane	ND		cis-1,3-Dichloropropene *	ND
	Methylene Chloride	ND		2-Chloroethylvinyl Ether	ND
1	Trichlorofluoromethane	2.4		Bromoform	ND
	1,1-Dichloroethene	ND		1,1,2,2-Tetrachloroethane #	ND
	1,1-Dichloroethane	ND		Tetrachloroethylene #	ND
2	trans-1,2-Dichloroethene	15.8		Chlorobenzene	ND
	Chloroform	ND		1,3-Dichlorobenzene	ND
	1,2-Dichloroethane	ND		1,2-Dichlorobenzene	ND
	1,1,1-Trichloroethane	ND		1,4-Dichlorobenzene	ND
	Carbon Tetrachloride	ND			
	Bromodichloromethane	ND			
	1,2-Dichloropropane	ND			
	trans-1,3-Dichloropropene	ND			

SAMPLE ID A051 FRACTION 04D TEST CODE GC 601 NAME EPA Method 601/GC
Date & Time Collected not specified Category

NOTES AND DEFINITIONS FOR THIS REPORT.

SCAN = scan number or retention time on chromatogram.
All results reported in ug/L unless otherwise specified.
ND = not detected at EPA detection limit method 601. (Federal Register, 12/3/79).
*Dibromochloromethane, 1,1,2-trichloroethane and cis-1,3-dichloropropene co-elute.
#1,1,2,2-tetrachloroethane and tetrachloroethylene co-elute

RADIAN CORPORATION

RECEIVED: 03/21/84

Analytical Serv REPORT
Results by Sample

LAB # 84-03-205

SAMPLE ID A051

FRACTION 04C TEST CODE GC 602 NAME EPA Method 602/GC
Date & Time Collected not specified Category

DATA FILE D
CONC. FACTOR

DATE INJECTED 04/05/84

ANALYST MCL
INSTRUMENT d

VERIFIED BY JSG
COMPOUNDS DETECTED 1

SCAN	COMPOUND	RESULT	SCAN	COMPOUND	RESULT
1	Benzene	8		1,3-Dichlorobenzene	ND
	Toluene	ND		1,2-Dichlorobenzene	ND
	Ethyl Benzene	ND		1,4-Dichlorobenzene	ND

NOTES AND DEFINITIONS FOR THIS REPORT.
SCAN = scan number or retention time on chromatogram.
All results reported in ug/L unless otherwise specified.
ND = not detected at EPA detection limit method 602, (Federal Register, 12/3/79).

RADIAN CORPORATION

RECEIVED: 03/21/84 NonReported Work

FRACTION AND TEST CODES FOR WORK NOT REPORTED ELSEWHERE

01D : DUP602
03D : DUP602
04E : DUP601 DUP602

RADIAN CORPORATION

PAGE 1 Analytical Serv REPORT LAB # 84-03-208
RECEIVED: 03/22/84 05/10/84 10:45:17

REPORT TO: Radian
Bl. 4
Austin

ATTEN: Wayne Pearce

CLIENT: BERGSTROM SAMPLES 24
COMPANY: Bergstrom AFB
FACILITY:

PREPARED BY: Radian Analytical Services
8501 MoPac Blvd
P.O. Box 9948
Austin, Texas 78766

ATTEN:
PHONE: (512) 454-4797

CERTIFIED BY

CONTACT: CONOVER

WORK ID: soil samples
TAKEN: WP
TRANS: hand
TYPE:
P.O. #: 212-027-11-05
INV. #: 3097

SAMPLE IDENTIFICATION

1	A001
02	A003
03	A004
04	A007
05	A012
06	A014
07	A015
08	A016
09	A017
10	A019
11	A021
12	A023
13	A025
14	A026
15	A028
16	A030
17	A032
18	A034
19	A037
20	A038
21	A040

Analytical Serv TEST CODES and NAMES used on this report

CD E	Cadmium, ICPES
CR E	Chromium, ICPES
NI E	Nickel, ICPES
ONG IR	Oil and Grease, Infrared
PB GA	Lead, low level
PREP X	Special Digestion Method

RADIAN CORPORATION

RECEIVED: 03/22/84

Analytical Serv REPORT
05/10/84 10:45:17

LAB # 84-03-208

SAMPLE IDENTIFICATION

22 A042
23 A044
24 A046

TEST CODE default units	Sample 01 (entered units)	Sample 02 (entered units)	Sample 03 (entered units)	Sample 04 (entered units)	Sample 05 (entered units)
CD_E ug/ml	<.083 ug/g	<.080 ug/g	0.67 ug/g	0.62 ug/g	<.086 ug/g
CR_E ug/ml	10 ug/g	3.9 ug/g	21 ug/g	12 ug/g	18 ug/g
NI_E ug/ml	6.2 ug/g	1.7 ug/g	12 ug/g	9.1 ug/g	9.8 ug/g
ONG_IR mg/L	400 ug/g	300 ug/g	300 ug/g	300 ug/g	300 ug/g
PB_GA ug/ml	5.8 ug/g	2.5 ug/g	14 ug/g	5.8 ug/g	7.4 ug/g
PREP_X date complete	03/26/84	03/26/84	03/26/84	03/26/84	03/26/84

TEST CODE default units	Sample 06 (entered units)	Sample 07 (entered units)	Sample 08 (entered units)	Sample 09 (entered units)	Sample 10 (entered units)
CD_E ug/ml	<.062 ug/g				
CR_E ug/ml	7.9 ug/g				
NI_E ug/ml	4.8 ug/g				
ONG_IR mg/L	280 ug/g	280 ug/g	300 ug/g	500 ug/g	400 ug/g
PB_GA ug/ml	9.4 ug/g				
PREP_X date complete	03/26/84				

RADIAN CORPORATION

RECEIVED: 03/22/84

Analytical Serv REPORT

RESULTS BY TEST

LAB # 84-03-208

TEST CODE default units	Sample 11 (entered units)	Sample 12 (entered units)	Sample 13 (entered units)	Sample 14 (entered units)	Sample 15 (entered units)
CD_E ug/ml			<.064 ug/g	<.080 ug/g	0.19 ug/g
CR_E ug/ml			19 ug/g	8.2 ug/g	15 ug/g
NI_E ug/ml			4.8 ug/g	4.8 ug/g	9.2 ug/g
ONG_IR mg/L	600 ug/g	600 ug/g	800 ug/g	600 ug/g	600 ug/g
PB_GA ug/ml			9.3 ug/g	9.7 ug/g	7.0 ug/g
PREP_X date complete			03/26/84	03/26/84	03/26/84

TEST CODE default units	Sample 16 (entered units)	Sample 17 (entered units)	Sample 18 (entered units)	Sample 19 (entered units)	Sample 20 (entered units)
CD_E ug/ml	<.076 ug/g	<.086 ug/g	<.070 ug/g	0.87 ug/g	0.85 ug/g
CR_E ug/ml	8.4 ug/g	9.4 ug/g	5.3 ug/g	27 ug/g	25 ug/g
NI_E ug/ml	7.2 ug/g	7.0 ug/g	5.3 ug/g	17 ug/g	18 ug/g
ONG_IR mg/L	800 ug/g	800 ug/g	800 ug/g	2100 ug/g	800 ug/g
PB_GA ug/ml	2.66 ug/g	2.8 ug/g	3.6 ug/g	35 ug/g	9.1 ug/g
PREP_X date complete	03/26/84	03/26/84	03/26/84	03/26/84	03/26/84

RADIAN CORPORATION

PAGE 5 Analytical Serv REPORT LAB # 84-03-208

RECEIVED: 03/22/84 RESULTS BY TEST

TEST CODE default units	Sample 21 (entered units)	Sample 22 (entered units)	Sample 23 (entered units)	Sample 24 (entered units)
CD_E ug/ml	<.077 ug/g	<.093 ug/g	<.077 ug/g	<.055 ug/g
CR_E ug/ml	12 ug/g	7.9 ug/g	8.3 ug/g	6.2 ug/g
NI_E ug/ml	8.1 ug/g	8.1 ug/g	7.1 ug/g	7.6 ug/g
ONG_IR mg/L	500 ug/g	400 ug/g	500 ug/g	400 ug/g
PB_GA ug/ml	6.7 ug/g	4.5 ug/g	3.4 ug/g	3.0 ug/g
PREP_X date complete	03/26/84	03/26/84	03/26/84	03/26/84

RADIAN CORPORATION

PAGE 1 Analytical Serv REPORT LAB # 84-04-120
RECEIVED: 04/13/84 05/10/84 09:49:09

REPORT TO Radian
Bl. 4
Austin

ATTEN Wayne Pearce

CLIENT BERGSTROM SAMPLES 13
COMPANY Bergstrom AFB
FACILITY

PREPARED BY Radian Analytical Services
8501 MoPac Blvd
P.O. Box 9948
Austin, Texas 78766

ATTEN
PHONE (512) 454-4797

CERTIFIED BY

CONTACT CONOVER

WORK ID sediments - South Fork
TAKEN RB
TRANS RB
TYPE
P.O. # 212-027-11-05
INVOICE under separate cover

SAMPLE IDENTIFICATION

01	A052
02	A053
03	A054
04	A055
05	A056
06	A057
07	A058
08	A059
09	A060
10	A061
11	A062
12	A063
13	A064

Analytical Serv TEST CODES and NAMES used on this report

CR E	Chromium, ICPES
CU E	Copper, ICPES
NI E	Nickel, ICPES
ONG IR	Oil and Grease, Infrared
PB GA	Lead, low level
PREP X	Special Digestion Method

RADIAN CORPORATION

RECEIVED: 04/13/84

Analytical Serv REPORT
RESULTS BY TEST

LAB # 84-04-120

TEST CODE default units	Sample 01 (entered units)	Sample 02 (entered units)	Sample 03 (entered units)	Sample 04 (entered units)	Sample 05 (entered units)
CR_E ug/ml	3.9 ug/g	11 ug/g	11.7 ug/g	21 ug/g	7.6 ug/g
CU_E ug/ml	4.2 ug/g	6.7 ug/g	10 ug/g	5.4 ug/g	5.8 ug/g
NI_E ug/ml	5.0 ug/g	9.8 ug/g	8.0 ug/g	16 ug/g	5.3 ug/g
ONG_IR mg/L	470	880	1910	1700	1990
PB_GA ug/ml	5.8 ug/g	10 ug/g	9.6 ug/g	10 ug/g	7.5 ug/g
PREP_X date complete	04/17/84	04/17/84	04/17/84	04/17/84	04/17/84

TEST CODE default units	Sample 06 (entered units)	Sample 07 (entered units)	Sample 08 (entered units)	Sample 09 (entered units)	Sample 10 (entered units)
CR_E ug/ml	6.7 ug/g	7.2 ug/g	0.74 ug/g	4.16 ug/g	10 ug/g
CU_E ug/ml	4.4 ug/g	4.1 ug/g	1.9 ug/g	3.46 ug/g	11.9 ug/g
NI_E ug/ml	6.3 ug/g	5.9 ug/g	1.5 ug/g	2.54 ug/g	7.4 ug/g
ONG_IR mg/L	<100	1810	1990	<100	1380
PB_GA ug/ml	11 ug/g	7.8 ug/g	4.5 ug/g	11 ug/g	15 ug/g
PREP_X date complete	04/17/84	04/17/84	04/17/84	04/17/84	04/17/84

RADIAN CORPORATION

Analytical Serv REPORT LAB # 84-04-120

RECEIVED: 04/13/84

RESULTS BY TEST

TEST CODE default units	Sample 11 (entered units)	Sample 12 (entered units)	Sample 13 (entered units)
CR_E ug/ml	13 ug/g	18 ug/g	79 ug/g
CU_E ug/ml	8.2 ug/g	240 ug/g	41 ug/g
NI_E ug/ml	9.8 ug/g	17 ug/g	8.7 ug/g
ONG_IR mg/L	1270	<100	950
PB_GA ug/ml	9.3 ug/g	21 ug/g	250 ug/g
PREP_X date complete	04/17/84	04/17/84	04/17/84

RADIAN
CORPORATION

Analytical Serv REPORT — LAB # 84-04-119

RECEIVED: 04/13/84 — 05/14/84 13:43:52

REPORT TO: Radian, Bl. 4, Austin

ATTEN: Wayne Pearce

CLIENT: BERGSTROM — SAMPLES: 6

COMPANY: Bergstrom AFB

FACILITY:

PREPARED BY: Radian Analytical Services, 8501 MoPac Blvd., P.O. Box 9948, Austin, Texas 78766

ATTEN:

PHONE: (512) 454-4797

CERTIFIED BY

CONTACT: CONOVER

WORK ID: groundwater

TAKEN: RB

TRANS: RB

TYPE:

P.O. #: 212-027-11-05

INVOICE: under separate cover

SAMPLE IDENTIFICATION

01	A065
02	A066
03	A067
04	A068
05	A069
06	A070

Analytical Serv TEST CODES and NAMES used on this report

AG E	Silver, ICPES
AS GA	Arsenic, low level
BA E	Barium, ICPES
CD E	Cadmium, ICPES
CR E	Chromium, ICPES
GCXTRA	Special GC analysis *
HERBES	Herbicides EC
HG CA	Mercury, Cold Vapor
ONG IR	Oil and Grease, Infrared
PB GA	Lead, low level
PESTES	EPA 608 Pesticides by EC
PHEN A	Total Phenolics
SE GA	Selenium, low level
TOC	Total Organic Carbon
TOX 1	TOX Single Analysis

RADIAN CORPORATION

RECEIVED: 04/13/84

Analytical Serv REPORT
RESULTS BY TEST

LAB # 84-04-119

TEST CODE default units	Sample 01 (entered units)	Sample 02 (entered units)	Sample 03 (entered units)	Sample 04 (entered units)	Sample 05 (entered units)
AG_E ug/ml	<.002	<.002	<.002	<.002	<.002
AS_GA ug/ml	<.003	<.003	<.003	<.002	<.002
BA_E ug/ml	<.001	<.001	<.001	<.001	<.001
CD_E ug/ml	<.002	0.008	0.009	<.002	0.008
CR_E ug/ml	0.017	0.004	0.014	<.001	<.001
HG_CA ug/ml	<.0002	<.0002	<.0002	<.0002	<.0002
ONG_IR mg/L	8	11	7	8	8
PB_GA ug/ml	<.002	<.002	<.002	<.002	<.002
PHEN_A mg/L	0.048	0.023	0.065	0.088	<.005
SE_GA ug/ml	<.003	<.003	<.003	<.003	<.003
TOC mg/L	<1	<1	<1	<1	<1
TOX_1 mg/L	<.02	<.01	<.01	<.01	<.01

RADIAN CORPORATION

 Analytical Serv REPORT LAB # 84-04-119

RECEIVED: 04/13/84

RESULTS BY TEST

TEST CODE default units	Sample 06 (entered units)
AG_E ug/ml	0.006
AS_GA ug/ml	<.002
BA_E ug/ml	<.001
CD_E ug/ml	0.034
CR_E ug/ml	0.063
HG_CA ug/ml	<.0002
ONG_IR mg/L	9
PB_GA ug/ml	<.002
PHEN_A mg/L	0.023
SE_GA ug/ml	<.003
TOC mg/L	<1
TOX_1 mg/L	<.01

RADIAN CORPORATION

PAGE 4 Analytical Serv REPORT LAB # 84-04-119
RECEIVED: 04/13/84 Results by Sample

SAMPLE ID A065 FRACTION 01E TEST CODE GCXTRA NAME Special GC analysis *
Date & Time Collected not specified Category

DATE EXTRACTED 04/20/84 VERIFIED BY LLN
DATE INJECTED 05/07/84 ANALYST DRL

COMPOUND	RESULT	UNITS
dibrom	ND	

RADIAN CORPORATION

RECEIVED: 04/13/84

Analytical Serv REPORT
Results by Sample

LAB # 84-04-119

SAMPLE ID A065

FRACTION 01E TEST CODE HERBES NAME Herbicides EC
Date & Time Collected not specified Category

DATE EXTRACTED 04/20/84
CONCENTRATION FACTOR

DATE INJECTED 05/07/84
ANALYST DRL

VERIFIED BY LLN

COMPOUND	RESULT	DET. LIMIT	OTHER HERBICIDES	RESULT	DET. LIMIT
2,4-D	<0.1				
2,4,5-TP (Silvex)	<0.1				

NOTES AND DEFINITIONS FOR THIS REPORT.
ND = not detected at the specified detection limit.
All results reported in micrograms/liter unless otherwise specified.

RADIAN CORPORATION

RECEIVED: 04/13/84

Analytical Serv REPORT
Results by Sample

LAB # 84-04-119

SAMPLE ID A065

FRACTION 01E TEST CODE PESTES NAME EPA 608 Pesticides by EC
Date & Time Collected not specified Category ____

DATA FILE 214050703
CONC. FACTOR ____

DATE EXTRACTED 04/20/84
DATE INJECTED 05/07/84

ANALYST DRL

VERIFIED BY LLN
COMPOUNDS DETECTED 0

NPDES SCAN	EPA	COMPOUND	RESULT	NPDES SCAN	EPA	COMPOUND	RESULT
1P	89P	aldrin	ND	2P	102P	alpha BHC	ND
10P	90P	dieldrin	ND	3P	103P	beta BHC	ND
6P	91P	chlordane	ND	4P	104P	gamma BHC	ND
7P	92P	4,4'-DDT	ND	5P	105P	delta BHC	ND
8P	93P	4,4'-DDE	ND	18P	106P	PCB-1242	ND
9P	94P	4,4'-DDD	ND	19P	107P	PCB-1254	ND
11P	95P	alpha endosulfan	ND	20P	108P	PCB-1221	ND
12P	96P	beta endosulfan	ND	21P	109P	PCB-1232	ND
14P	97P	endosulfan sulfate	ND	22P	110P	PCB-1248	ND
14P	98P	endrin	ND	23P	111P	PCB-1260	ND
15P	99P	endrin aldehyde	ND	24P	112P	PCB-1016	ND
16P	100P	heptachlor	ND	25P	113P	toxaphene	ND
17P	101P	heptachlor epoxide	ND				

RECEIVED: 04/13/84 Results by Sample Continued From Above

SAMPLE ID A065 FRACTION 01E TEST CODE PESTES NAME EPA 608 Pesticides by EC
Date & Time Collected not specified Category

NOTES AND DEFINITIONS FOR THIS REPORT.
SCAN = scan number on chromatogram.
All results reported in micrograms/liter unless otherwise specified.
ND = not detected at EPA detection limit method 608, (Federal Register, 12/3/79).

RADIAN CORPORATION

RECEIVED: 04/13/84

Analytical Serv REPORT
Results by Sample

LAB # 84-04-119

SAMPLE ID A066

FRACTION 02E TEST CODE GCXTRA NAME Special GC analysis *
Date & Time Collected not specified Category

VERIFIED BY LLN
ANALYST DRL

DATE EXTRACTED 04/20/84
DATE INJECTED 05/07/84

COMPOUND	RESULT	UNITS
dibrom	ND	

RADIAN CORPORATION

RECEIVED: 04/13/84

Analytical Serv REPORT
Results by Sample

LAB # 84-04-119

SAMPLE ID A066

FRACTION 02E TEST CODE HERBES NAME Herbicides EC
Date & Time Collected not specified Category

DATE EXTRACTED 04/20/84
CONCENTRATION FACTOR

DATE INJECTED 05/07/84
ANALYST DRL

VERIFIED BY LLN

COMPOUND	RESULT	DET. LIMIT	OTHER HERBICIDES	RESULT	DET. LIMIT
2,4-D	<0.1				
2,4,5-TP (Silvex)	<0.1				

NOTES AND DEFINITIONS FOR THIS REPORT.
ND = not detected at the specified detection limit.
All results reported in micrograms/liter unless otherwise specified.

RADIAN CORPORATION

RECEIVED: 04/13/84

Analytical Serv REPORT

Results by Sample

LAB # 84-04-119

SAMPLE ID A066

FRACTION 02E TEST CODE PESTES NAME EPA 608 Pesticides by EC

Date & Time Collected not specified Category

DATA FILE 214050704 DATE EXTRACTED 04/20/84 ANALYST DRL VERIFIED BY LLN

CONC. FACTOR DATE INJECTED 05/07/84 COMPOUNDS DETECTED 0

NPDES SCAN	EPA	COMPOUND	RESULT	NPDES SCAN	EPA	COMPOUND	RESULT
1P	89P	aldrin	ND	2P	102P	alpha BHC	ND
10P	90P	dieldrin	ND	3P	103P	beta BHC	ND
6P	91P	chlordane	ND	4P	104P	gamma BHC	ND
7P	92P	4,4'-DDT	ND	5P	105P	delta BHC	ND
8P	93P	4,4'-DDE	ND	18P	106P	PCB-1242	ND
9P	94P	4,4'-DDD	ND	19P	107P	PCB-1254	ND
11P	95P	alpha endosulfan	ND	20P	108P	PCB-1221	ND
12P	96P	beta endosulfan	ND	21P	109P	PCB-1232	ND
14P	97P	endosulfan sulfate	ND	22P	110P	PCB-1248	ND
14P	98P	endrin	ND	23P	111P	PCB-1260	ND
15P	99P	endrin aldehyde	ND	24P	112P	PCB-1016	ND
16P	100P	heptachlor	ND	25P	113P	toxaphene	ND
17P	101P	heptachlor epoxide	ND				

RADIAN CORPORATION

RECEIVED: 04/13/84

Analytical Serv REPORT
Results by Sample

LAB # 84-04-119
Continued From Above

SAMPLE ID A066

FRACTION 02E TEST CODE PESTES NAME EPA 608 Pesticides by EC
Date & Time Collected not specified Category

NOTES AND DEFINITIONS FOR THIS REPORT.
SCAN = scan number on chromatogram.
All results reported in micrograms/liter unless otherwise specified.
ND = not detected at EPA detection limit method 608, (Federal Register, 12/3/79).

RADIAN CORPORATION

RECEIVED: 04/13/84

Analytical Serv REPORT
Results by Sample

LAB # 84-04-119

SAMPLE ID A067

FRACTION 03E TEST CODE GCXTRA NAME Special GC analysis *
Date & Time Collected not specified Category

DATE EXTRACTED 04/20/84
DATE INJECTED 05/07/84

VERIFIED BY LLN
ANALYST DRL

COMPOUND	RESULT	UNITS
dibrom	ND	

RADIAN CORPORATION

RECEIVED: 04/13/84

Analytical Serv REPORT
Results by Sample

LAB # 84-04-119

SAMPLE ID A067

FRACTION 03E TEST CODE HERBES NAME Herbicides EC
Date & Time Collected not specified Category

DATE EXTRACTED 04/20/84
CONCENTRATION FACTOR

DATE INJECTED 05/07/84
ANALYST DRL

VERIFIED BY LLN

COMPOUND	RESULT	DET. LIMIT	OTHER HERBICIDES	RESULT	DET. LIMIT
2,4-D	<0.1				
2,4,5-TP (Silvex)	<0.1				

NOTES AND DEFINITIONS FOR THIS REPORT.
ND = not detected at the specified detection limit.
All results reported in micrograms/liter unless otherwise specified.

RADIAN CORPORATION

PAGE 14 | Analytical Serv | REPORT | LAB # 84-04-119

RECEIVED: 04/13/84 | Results by Sample

SAMPLE ID A067 | FRACTION 03E | TEST CODE PESTES | NAME EPA 608 Pesticides by EC

Date & Time Collected not specified | Category

DATA FILE 214050705 | DATE EXTRACTED 04/20/84 | ANALYST DRL | VERIFIED BY LLN

CONC. FACTOR | DATE INJECTED 05/07/84 | COMPOUNDS DETECTED 0

NPDES SCAN	EPA	COMPOUND	RESULT	NPDES SCAN	EPA	COMPOUND	RESULT
1P	89P	aldrin	ND	2P	102P	alpha BHC	ND
10P	90P	dieldrin	ND	3P	103P	beta BHC	ND
6P	91P	chlordane	ND	4P	104P	gamma BHC	ND
7P	92P	4,4'-DDT	ND	5P	105P	delta BHC	ND
8P	93P	4,4'-DDE	ND	18P	106P	PCB-1242	ND
9P	94P	4,4'-DDD	ND	19P	107P	PCB-1254	ND
11P	95P	alpha endosulfan	ND	20P	108P	PCB-1221	ND
12P	96P	beta endosulfan	ND	21P	109P	PCB-1232	ND
14P	97P	endosulfan sulfate	ND	22P	110P	PCB-1248	ND
14P	98P	endrin	ND	23P	111P	PCB-1260	ND
15P	99P	endrin aldehyde	ND	24P	112P	PCB-1016	ND
16P	100P	heptachlor	ND	25P	113P	toxaphene	ND
17P	101P	heptachlor epoxide	ND				

RADIAN CORPORATION

RECEIVED: 04/13/84 Analytical Serv REPORT LAB # 84-04-119
Results by Sample Continued From Above

SAMPLE ID A067 FRACTION 03E TEST CODE PESTES NAME EPA 608 Pesticides by EC
Date & Time Collected not specified Category

NOTES AND DEFINITIONS FOR THIS REPORT.
SCAN = scan number on chromatogram.
All results reported in micrograms/liter unless otherwise specified.
ND = not detected at EPA detection limit method 608, (Federal Register, 12/3/79).

RADIAN CORPORATION

RECEIVED: 04/13/84

Analytical Serv REPORT
Results by Sample

LAB # 84-04-119

SAMPLE ID A068

FRACTION 04E TEST CODE GCXTRA NAME Special GC analysis *
Date & Time Collected not specified Category

DATE EXTRACTED 04/20/84
DATE INJECTED 05/07/84

VERIFIED BY LLN
ANALYST DRL

COMPOUND	RESULT	UNITS
dibrom	ND	

RADIAN CORPORATION

RECEIVED: 04/13/84

Analytical Serv REPORT
Results by Sample

LAB # 84-04-119

SAMPLE ID A068

FRACTION 04E TEST CODE HERBES NAME Herbicides EC
Date & Time Collected not specified Category ______

DATE EXTRACTED 04/20/84
CONCENTRATION FACTOR

DATE INJECTED 05/07/84
ANALYST DRL

VERIFIED BY LLN

COMPOUND	RESULT	DET. LIMIT	OTHER HERBICIDES	RESULT	DET. LIMIT
2,4-D	<0.1	______			
2,4,5-TP (Silvex)	<0.1	______			

NOTES AND DEFINITIONS FOR THIS REPORT.
ND = not detected at the specified detection limit.
All results reported in micrograms/liter unless otherwise specified.

RADIAN CORPORATION

RECEIVED: 04/13/84

Analytical Serv REPORT
Results by Sample

LAB # 84-04-119

SAMPLE ID A068 FRACTION 04E TEST CODE PESTES NAME EPA 608 Pesticides by EC
Date & Time Collected not specified Category

DATA FILE 214050706 DATE EXTRACTED 04/20/84 ANALYST DRL VERIFIED BY LLN
CONC. FACTOR DATE INJECTED 05/07/84 COMPOUNDS DETECTED 0

NPDES SCAN	EPA	COMPOUND	RESULT	NPDES SCAN	EPA	COMPOUND	RESULT
1P	89P	aldrin	ND	2P	102P	alpha BHC	ND
10P	90P	dieldrin	ND	3P	103P	beta BHC	ND
6P	91P	chlordane	ND	4P	104P	gamma BHC	ND
7P	92P	4,4'-DDT	ND	5P	105P	delta BHC	ND
8P	93P	4,4'-DDE	ND	18P	106P	PCB-1242	ND
9P	94P	4,4'-DDD	ND	19P	107P	PCB-1254	ND
11P	95P	alpha endosulfan	ND	20P	108P	PCB-1221	ND
12P	96P	beta endosulfan	ND	21P	109P	PCB-1232	ND
14P	97P	endosulfan sulfate	ND	22P	110P	PCB-1248	ND
14P	98P	endrin	ND	23P	111P	PCB-1260	ND
15P	99P	endrin aldehyde	ND	24P	112P	PCB-1016	ND
16P	100P	heptachlor	ND	25P	113P	toxaphene	ND
17P	101P	heptachlor epoxide	ND				

RADIAN CORPORATION

RECEIVED: 04/13/84

Analytical Serv REPORT
Results by Sample

LAB # 84-04-119
Continued From Above

SAMPLE ID A068 FRACTION 04E TEST CODE PESTES NAME EPA 608 Pesticides by EC
Date & Time Collected not specified Category

NOTES AND DEFINITIONS FOR THIS REPORT.
SCAN = scan number on chromatogram.
All results reported in micrograms/liter unless otherwise specified.
ND = not detected at EPA detection limit method 608, (Federal Register, 12/3/79).

RADIAN CORPORATION

RECEIVED: 04/13/84

Analytical Serv REPORT
Results by Sample

LAB # 84-04-119

SAMPLE ID A069

FRACTION 05E TEST CODE GCXTRA NAME Special GC analysis #
Date & Time Collected not specified Category

DATE EXTRACTED 04/20/84
DATE INJECTED 05/07/84

VERIFIED BY LLN
ANALYST DRL

COMPOUND	RESULT	UNITS
dibrom	ND	

RADIAN CORPORATION

PAGE 21 Analytical Serv REPORT LAB # 84-04-119
RECEIVED: 04/13/84 Results by Sample

SAMPLE ID A069 FRACTION 05E TEST CODE HERBES NAME Herbicides EC
Date & Time Collected not specified Category

DATE EXTRACTED 04/20/84 DATE INJECTED 05/07/84 VERIFIED BY LLN
CONCENTRATION FACTOR ANALYST DRL

COMPOUND	RESULT	DET. LIMIT	OTHER HERBICIDES	RESULT	DET. LIMIT
2,4-D	<0.1				
2,4,5-TP (Silvex)	<0.1				

NOTES AND DEFINITIONS FOR THIS REPORT.
ND = not detected at the specified detection limit.
All results reported in micrograms/liter unless otherwise specified.

RADIAN CORPORATION

RECEIVED: 04/13/84

Analytical Serv REPORT
Results by Sample

LAB # 84-04-119

SAMPLE ID A069

FRACTION 05E TEST CODE PESTES NAME EPA 608 Pesticides by EC
Date & Time Collected not specified Category

DATA FILE 214050707
CONC. FACTOR

DATE EXTRACTED 04/20/84
DATE INJECTED 05/07/84

ANALYST DRL

VERIFIED BY LLN
COMPOUNDS DETECTED 0

NPDES SCAN	EPA	COMPOUND	RESULT	NPDES SCAN	EPA	COMPOUND	RESULT
1P	89P	aldrin	ND	2P	102P	alpha BHC	ND
10P	90P	dieldrin	ND	3P	103P	beta BHC	ND
6P	91P	chlordane	ND	4P	104P	gamma BHC	ND
7P	92P	4,4'-DDT	ND	5P	105P	delta BHC	ND
8P	93P	4,4'-DDE	ND	18P	106P	PCB-1242	ND
9P	94P	4,4'-DDD	ND	19P	107P	PCB-1254	ND
11P	95P	alpha endosulfan	ND	20P	108P	PCB-1221	ND
12P	96P	beta endosulfan	ND	21P	109P	PCB-1232	ND
14P	97P	endosulfan sulfate	ND	22P	110P	PCB-1248	ND
14P	98P	endrin	ND	23P	111P	PCB-1260	ND
15P	99P	endrin aldehyde	ND	24P	112P	PCB-1016	ND
16P	100P	heptachlor	ND	25P	113P	toxaphene	ND
17P	101P	heptachlor epoxide	ND				

RECEIVED: 04/13/84

Analytical Serv REPORT
Results by Sample

LAB # 84-04-119
Continued From Above

SAMPLE ID A069

FRACTION 05E TEST CODE PESTES NAME EPA 608 Pesticides by EC
Date & Time Collected not specified Category

NOTES AND DEFINITIONS FOR THIS REPORT.
SCAN = scan number on chromatogram.
All results reported in micrograms/liter unless otherwise specified.
ND = not detected at EPA detection limit method 608, (Federal Register, 12/3/79).

RADIAN CORPORATION

RECEIVED: 04/13/84

Analytical Serv REPORT
Results by Sample

LAB # 84-04-119

SAMPLE ID A070

FRACTION 06E TEST CODE GCXTRA NAME Special GC analysis *
Date & Time Collected not specified Category

DATE EXTRACTED 04/20/84
DATE INJECTED 05/07/84

VERIFIED BY LLN
ANALYST DRL

COMPOUND	RESULT	UNITS
dibrom	ND	

RADIAN CORPORATION

RECEIVED: 04/13/84

Analytical Serv REPORT
Results by Sample

LAB # 84-04-119

SAMPLE ID A070

FRACTION 06E TEST CODE HERBES NAME Herbicides EC
Date & Time Collected not specified Category ____

DATE EXTRACTED 04/20/84
CONCENTRATION FACTOR

DATE INJECTED 05/07/84
ANALYST DRL

VERIFIED BY LLN

COMPOUND	RESULT	DET. LIMIT	OTHER HERBICIDES	RESULT	DET. LIMIT
2,4-D	<0.1	____			
2,4,5-TP (Silvex)	<0.1	____			

NOTES AND DEFINITIONS FOR THIS REPORT.
ND = not detected at the specified detection limit.
All results reported in micrograms/liter unless otherwise specified.

RADIAN CORPORATION

RECEIVED: 04/13/84

Analytical Serv REPORT
Results by Sample

LAB # 84-04-119

SAMPLE ID A070

FRACTION 06E TEST CODE PESTES NAME EPA 608 Pesticides by EC
Date & Time Collected not specified Category

DATA FILE 214050708
CONC. FACTOR

DATE EXTRACTED 04/20/84
DATE INJECTED 05/07/84

ANALYST DRL

VERIFIED BY LLN
COMPOUNDS DETECTED 0

NPDES SCAN	EPA	COMPOUND	RESULT	NPDES SCAN	EPA	COMPOUND	RESULT
1P	89P	aldrin	ND	2P	102P	alpha BHC	ND
10P	90P	dieldrin	ND	3P	103P	beta BHC	ND
6P	91P	chlordane	ND	4P	104P	gamma BHC	ND
7P	92P	4,4'-DDT	ND	5P	105P	delta BHC	ND
8P	93P	4,4'-DDE	ND	18P	106P	PCB-1242	ND
9P	94P	4,4'-DDD	ND	19P	107P	PCB-1254	ND
11P	95P	alpha endosulfan	ND	20P	108P	PCB-1221	ND
12P	96P	beta endosulfan	ND	21P	109P	PCB-1232	ND
14P	97P	endosulfan sulfate	ND	22P	110P	PCB-1248	ND
14P	98P	endrin	ND	23P	111P	PCB-1260	ND
15P	99P	endrin aldehyde	ND	24P	112P	PCB-1016	ND
16P	100P	heptachlor	ND	25P	113P	toxaphene	ND
17P	101P	heptachlor epoxide	ND				

RADIAN CORPORATION

RECEIVED: 04/13/84 Analytical Serv REPORT LAB # 84-04-119

Results by Sample Continued From Above

SAMPLE ID A070 FRACTION 06E TEST CODE PESTES NAME EPA 608 Pesticides by EC

Date & Time Collected not specified Category

NOTES AND DEFINITIONS FOR THIS REPORT.

SCAN = scan number on chromatogram.

All results reported in micrograms/liter unless otherwise specified.

ND = not detected at EPA detection limit method 608. (Federal Register, 12/3/79).

RADIAN CORPORATION

PAGE 1 | Analytical Serv REPORT | LAB # 84-04-116

RECEIVED: 04/16/84 | 04/23/84 15:51:24

REPORT TO: Radian
Bl. 4
Austin

ATTEN: Wayne Pearce

CLIENT: BERGSTROM   SAMPLES: 3
COMPANY: Bergstrom AFB
FACILITY:

PREPARED BY: Radian Analytical Services
8501 MoPac Blvd.
P.O. Box 9948
Austin, Texas 78766

ATTEN:
PHONE: (512) 454-4797

CERTIFIED BY

CONTACT: CONOVER

Note: detection limit is 1 ug/g.

WORK ID: PCB in soil
TAKEN: EWP, RB
TRANS: EWP, RB
TYPE:
P.O. #: 212-027-11-05
INVOICE: under separate cover

SAMPLE IDENTIFICATION

01 A071
02 A072
03 A073

Analytical Serv TEST CODES and NAMES used on this report

PCB SO PCBs in Soil

RECEIVED: 04/16/84

Analytical Serv REPORT
RESULTS BY TEST

LAB # 84-04-116

TEST CODE default units	Sample 01 (entered units)	Sample 02 (entered units)	Sample 03 (entered units)
PCB_SO ug/g	ND	ND	ND

RADIAN CORPORATION

PAGE 1 Analytical Serv REPORT LAB # 84-05-059
RECEIVED: 05/11/84 07/09/84 12:11:34

REPORT TO	Radian Bl. 4 Austin	PREPARED BY	Radian Analytical Services 8501 MoPac Blvd. P.O. Box 9948 Austin, Texas 78766
ATTEN	Wayne Pearce	ATTEN	
		PHONE	(512) 454-4797
CLIENT	BERGSTROM SAMPLES 7		
COMPANY	Bergstrom AFB		
FACILITY			
WORK ID	groundwater		
TAKEN	EWP, RB		
TRANS	EWP, RB		
TYPE			
P.O. #	212-027-11-05		
INVOICE	under separate cover		

Louise Newman
CERTIFIED BY

CONTACT CONOVER

SAMPLE IDENTIFICATION

01	A074
02	A075
03	A076
04	A077
05	A078
06	A079
07	A080

Analytical Serv TEST CODES and NAMES used on this report

AG E	Silver, ICPES
AS GA	Arsenic, low level
BA E	Barium, ICPES
CD E	Cadmium, ICPES
CR E	Chromium, ICPES
GCXTRA	Special GC analysis *
HERBES	Herbicides EC
HG CA	Mercury, Cold Vapor
ONG IR	Oil and Grease, Infrared
PB GA	Lead, low level
PESTES	EPA 608 Pesticides by EC
PHEN A	Total Phenolics
SE GA	Selenium, low level
TOC	Total Organic Carbon
TOX 1	TOX Single Analysis

RADIAN CORPORATION

RECEIVED: 05/11/84

Analytical Serv REPORT
Results by Sample

LAB # 84-05-059

SAMPLE ID A074 SAMPLE # 01 FRACTIONS: A,B,C,D,E
Date & Time Collected not specified Category

AG_E	<.002	ug/ml
AS_GA	<.002	ug/ml
BA_E	0.061	ug/ml
CD_E	<.002	ug/ml
CR_E	<.001	ug/ml
HG_CA	<.0002	ug/ml
ONG_IR	2	mg/L
PB_GA	<.002	ug/ml
PHEN_A	0.018	mg/L
SE_GA	<.002	ug/ml
TOC	5	mg/L
TOX_1	<.01	mg/L

RADIAN CORPORATION

PAGE 3 Analytical Serv REPORT LAB # 84-05-059
RECEIVED: 05/11/84 Results by Sample

SAMPLE ID A074 FRACTION 01D TEST CODE GCXTRA NAME Special GC analysis #
Date & Time Collected not specified Category

DATE EXTRACTED 05/20/84 VERIFIED BY LLN
DATE INJECTED 05/30/84 ANALYST DR

COMPOUND	RESULT	UNITS
Dibrom	ND	ug/L

RADIAN
CORPORATION

RECEIVED: 05/11/84

Analytical Serv REPORT
Results by Sample

LAB # 84-05-059

SAMPLE ID A074

FRACTION 01D TEST CODE HERBES NAME Herbicides EC
Date & Time Collected not specified Category ______

DATE EXTRACTED 05/25/84
CONCENTRATION FACTOR

DATE INJECTED 06/06/84
ANALYST DRL

VERIFIED BY LLN

COMPOUND	RESULT	DET. LIMIT	OTHER HERBICIDES	RESULT	DET. LIMIT
2,4-D	<.1				
2,4,5-TP (Silvex)	<.1				

NOTES AND DEFINITIONS FOR THIS REPORT.
ND = not detected at the specified detection limit.
All results reported in micrograms/liter unless otherwise specified.

RADIAN CORPORATION

PAGE 5 Analytical Serv REPORT LAB # 84-05-059
RECEIVED: 05/11/84 Results by Sample

SAMPLE ID A074 FRACTION 01D TEST CODE PESTES NAME EPA 608 Pesticides by EC
Date & Time Collected not specified Category

DATA FILE 2140503003 DATE EXTRACTED 05/20/84 ANALYST DRL VERIFIED BY LLN
CONC. FACTOR DATE INJECTED 05/30/84 COMPOUNDS DETECTED 0

NPDES SCAN	EPA	COMPOUND	RESULT	NPDES SCAN	EPA	COMPOUND	RESULT
1P	89P	aldrin	ND	2P	102P	alpha BHC	ND
10P	90P	dieldrin	ND	3P	103P	beta BHC	ND
6P	91P	chlordane	ND	4P	104P	gamma BHC	ND
7P	92P	4,4'-DDT	ND	5P	105P	delta BHC	ND
8P	93P	4,4'-DDE	ND	18P	106P	PCB-1242	ND
9P	94P	4,4'-DDD	ND	19P	107P	PCB-1254	ND
11P	95P	alpha endosulfan	ND	20P	108P	PCB-1221	ND
12P	96P	beta endosulfan	ND	21P	109P	PCB-1232	ND
14P	97P	endosulfan sulfate	ND	22P	110P	PCB-1248	ND
14P	98P	endrin	ND	23P	111P	PCB-1260	ND
15P	99P	endrin aldehyde	ND	24P	112P	PCB-1016	ND
16P	100P	heptachlor	ND	25P	113P	toxaphene	ND
17P	101P	heptachlor epoxide	ND				

RADIAN CORPORATION

RECEIVED: 05/11/84

Analytical Serv REPORT
Results by Sample

LAB # 84-05-059
Continued From Above

SAMPLE ID A074

FRACTION 01D TEST CODE PESTES NAME EPA 608 Pesticides by EC
Date & Time Collected not specified Category

NOTES AND DEFINITIONS FOR THIS REPORT.
SCAN = scan number on chromatogram.
All results reported in micrograms/liter unless otherwise specified.
ND = not detected at EPA detection limit method 608, (Federal Register, 12/3/79).

RADIAN CORPORATION

PAGE 7 Analytical Serv REPORT LAB # 84-05-059
RECEIVED: 05/11/84 Results by Sample

SAMPLE ID A075 SAMPLE # 02 FRACTIONS: A,B,C,D,E
Date & Time Collected not specified Category

AG_E <.002 ug/ml	AS_GA <.002 ug/ml	BA_E 0.048 ug/ml	CD_E <.002 ug/ml	CR_E <.001 ug/ml	HG_CA <.0002 ug/ml
ONG_IR <1 mg/L	PB_GA <.002 ug/ml	PHEN_A 0.010 mg/L	SE_GA <.002 ug/ml	TOC 11 mg/L	TOX_1 <.01 mg/L

RADIAN CORPORATION

PAGE 8
RECEIVED: 05/11/84

Analytical Serv REPORT
Results by Sample

LAB # 84-05-059

SAMPLE ID A075

FRACTION 02D TEST CODE GCXTRA NAME Special GC analysis *
Date & Time Collected not specified Category

DATE EXTRACTED 05/20/84
DATE INJECTED 05/30/84

VERIFIED BY LLN
ANALYST DRL

COMPOUND	RESULT	UNITS
Dibrom	ND	ug/L

RADIAN CORPORATION

RECEIVED: 05/11/84

Analytical Serv REPORT
Results by Sample

LAB # 84-05-059

SAMPLE ID A075

FRACTION 02D TEST CODE HERBES NAME Herbicides EC
Date & Time Collected not specified Category ______

DATE EXTRACTED 05/25/84
CONCENTRATION FACTOR

DATE INJECTED 06/06/84
ANALYST DRL

VERIFIED BY LLN

COMPOUND	RESULT	DET. LIMIT	OTHER HERBICIDES	RESULT	DET. LIMIT
2,4-D	<.1	______			
2,4,5-TP (Silvex)	<.1	______			

NOTES AND DEFINITIONS FOR THIS REPORT.
ND = not detected at the specified detection limit.
All results reported in micrograms/liter unless otherwise specified.

RADIAN
CORPORATION

RECEIVED: 05/11/84

Analytical Serv REPORT
Results by Sample

LAB # 84-05-059

SAMPLE ID A075

FRACTION 02D TEST CODE PESTES NAME EPA 608 Pesticides by EC
Date & Time Collected not specified Category

DATA FILE 214053004
CONC. FACTOR

DATE EXTRACTED 05/20/84
DATE INJECTED 05/30/84

ANALYST DRL

VERIFIED BY LLN
COMPOUNDS DETECTED 0

NPDES SCAN	EPA	COMPOUND	RESULT	NPDES SCAN	EPA	COMPOUND	RESULT
1P	89P	aldrin	ND	2P	102P	alpha BHC	ND
10P	90P	dieldrin	ND	3P	103P	beta BHC	ND
6P	91P	chlordane	ND	4P	104P	gamma BHC	ND
7P	92P	4,4'-DDT	ND	5P	105P	delta BHC	ND
8P	93P	4,4'-DDE	ND	18P	106P	PCB-1242	ND
9P	94P	4,4'-DDD	ND	19P	107P	PCB-1254	ND
11P	95P	alpha endosulfan	ND	20P	108P	PCB-1221	ND
12P	96P	beta endosulfan	ND	21P	109P	PCB-1232	ND
14P	97P	endosulfan sulfate	ND	22P	110P	PCB-1248	ND
14P	98P	endrin	ND	23P	111P	PCB-1260	ND
15P	99P	endrin aldehyde	ND	24P	112P	PCB-1016	ND
16P	100P	heptachlor	ND	25P	113P	toxaphene	ND
17P	101P	heptachlor epoxide	ND				

RADIAN CORPORATION

RECEIVED: 05/11/84

Analytical Serv REPORT
Results by Sample

LAB # 84-05-059
Continued From Above

SAMPLE ID A075

FRACTION 02D TEST CODE PESTES NAME EPA 608 Pesticides by EC
Date & Time Collected not specified Category

NOTES AND DEFINITIONS FOR THIS REPORT.
SCAN = scan number on chromatogram.
All results reported in micrograms/liter unless otherwise specified.
ND = not detected at EPA detection limit method 608, (Federal Register, 12/3/79).

RECEIVED:

SAMPLE ID

DATA F
CONC. FAC

NPDES SCA

1P
10P
6P
7P
8P
9P
11P
12P
14P
14P
15P
16P
17P

RADIAN CORPORATION

RECEIVED: 05/11/84

Analytical Serv REPORT
Results by Sample

LAB # 84-05-059

SAMPLE ID A076 SAMPLE # 03 FRACTIONS: A,B,C,D,E
Date & Time Collected not specified Category

AG_E <.002 ug/ml	AS_GA <.002 ug/ml	BA_E 0.070 ug/ml	CD_E <.002 ug/ml	CR_E <.001 ug/ml	HG_CA <.0002 ug/ml
ONG_IR <.01 mg/L	PB_GA 0.004 ug/ml	PHEN_A 0.009 mg/L	SE_GA <.002 ug/ml	TOC 7 mg/L	TOX_1 <.01 mg/L

RADIAN CORPORATION

RECEIVED: 05/11/84

Analytical Serv REPORT
Results by Sample

LAB # 84-05-059

SAMPLE ID A076

FRACTION 03D TEST CODE GCXTRA NAME Special GC analysis *
Date & Time Collected not specified Category

DATE EXTRACTED 05/20/84
DATE INJECTED 05/30/84

VERIFIED BY LLN
ANALYST DRL

COMPOUND	RESULT	UNITS
Dibrom	ND	ug/L

RADIAN CORPORATION

RECEIVED: 05/11/84

Analytical Serv REPORT
Results by Sample

LAB # 84-05-059

SAMPLE ID A076

FRACTION 03D TEST CODE HERBES NAME Herbicides EC
Date & Time Collected not specified Category

DATE EXTRACTED 05/25/84
CONCENTRATION FACTOR

DATE INJECTED 06/06/84
ANALYST DRL

VERIFIED BY LLN

COMPOUND	RESULT	DET. LIMIT	OTHER HERBICIDES	RESULT	DET. LIMIT
2,4-D	<.1				
2,4,5-TP (Silvex)	<.1				

NOTES AND DEFINITIONS FOR THIS REPORT.
ND = not detected at the specified detection limit.
All results reported in micrograms/liter unless otherwise specified.

RADIAN CORPORATION

RECEIVED: 05/11/84

Analytical Serv REPORT
Results by Sample

LAB # 84-05-059

SAMPLE ID A076

FRACTION 03D TEST CODE PESTES NAME EPA 608 Pesticides by EC
Date & Time Collected not specified Category

DATA FILE 214053005
CONC. FACTOR

DATE EXTRACTED 05/20/84
DATE INJECTED 05/30/84

ANALYST DRL

VERIFIED BY LLN
COMPOUNDS DETECTED 0

NPDES SCAN	EPA	COMPOUND	RESULT	NPDES SCAN	EPA	COMPOUND	RESULT
1P	89P	aldrin	ND	2P	102P	alpha BHC	ND
10P	90P	dieldrin	ND	3P	103P	beta BHC	ND
6P	91P	chlordane	ND	4P	104P	gamma BHC	ND
7P	92P	4,4'-DDT	ND	5P	105P	delta BHC	ND
8P	93P	4,4'-DDE	ND	18P	106P	PCB-1242	ND
9P	94P	4,4'-DDD	ND	19P	107P	PCB-1254	ND
11P	95P	alpha endosulfan	ND	20P	108P	PCB-1221	ND
12P	96P	beta endosulfan	ND	21P	109P	PCB-1232	ND
14P	97P	endosulfan sulfate	ND	22P	110P	PCB-1248	ND
14P	98P	endrin	ND	23P	111P	PCB-1260	ND
15P	99P	endrin aldehyde	ND	24P	112P	PCB-1016	ND
16P	100P	heptachlor	ND	25P	113P	toxaphene	ND
17P	101P	heptachlor epoxide	ND				

RADIAN CORPORATION

RECEIVED: 05/11/84

Analytical Serv REPORT
Results by Sample

LAB # 84-05-059
Continued From Above

SAMPLE ID A076

FRACTION 03D TEST CODE PESTES NAME EPA 608 Pesticides by EC
Date & Time Collected not specified Category

NOTES AND DEFINITIONS FOR THIS REPORT.
SCAN = scan number on chromatogram.
All results reported in micrograms/liter unless otherwise specified.
ND = not detected at EPA detection limit method 608, (Federal Register, 12/3/79).

RADIAN CORPORATION

PAGE 17 Analytical Serv REPORT LAB # 84-05-059
RECEIVED: 05/11/84 Results by Sample

SAMPLE ID A077 SAMPLE # 04 FRACTIONS: A,B,C,D,E
Date & Time Collected not specified Category

AG_E	<.002 ug/ml	AS_GA	<.002 ug/ml	BA_E	0.072 ug/ml	CD_E	<.002 ug/ml	CR_E	<.001 ug/ml	HG_CA	<.0002 ug/ml
ONG_IR	<1 mg/L	PB_GA	0.003 ug/ml	PHEN_A	0.014 mg/L	SE_GA	<.002 ug/ml	TOC	7 mg/L	TOX_1	<.01 mg/L

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RECEIVED: 05/11/84

Analytical Serv REPORT
Results by Sample

LAB # 84-05-059

SAMPLE ID A077

FRACTION 04D TEST CODE GCXTRA NAME Special GC analysis *
Date & Time Collected not specified Category

DATE EXTRACTED 05/20/84
DATE INJECTED 05/30/84

VERIFIED BY LLN
ANALYST DRL

COMPOUND	RESULT	UNITS
Dibrom	ND	ug/L

RADIAN CORPORATION

RECEIVED: 05/11/84

Analytical Serv REPORT
Results by Sample

LAB # 84-05-059

SAMPLE ID A077

FRACTION 04D TEST CODE HERBES NAME Herbicides EC
Date & Time Collected not specified Category

DATE EXTRACTED 05/25/84
CONCENTRATION FACTOR

DATE INJECTED 06/06/84
ANALYST DRL

VERIFIED BY LLN

COMPOUND	RESULT	DET. LIMIT	OTHER HERBICIDES	RESULT	DET. LIMIT
2,4-D	<.1				
2,4,5-TP (Silvex)	<.1				

NOTES AND DEFINITIONS FOR THIS REPORT.
ND = not detected at the specified detection limit.
All results reported in micrograms/liter unless otherwise specified.

RADIAN CORPORATION

RECEIVED: 05/11/84

Analytical Serv REPORT
Results by Sample

LAB # 84-05-059

SAMPLE ID A077

FRACTION 04D TEST CODE PESTES NAME EPA 608 Pesticides by EC
Date & Time Collected not specified Category

DATA FILE 214053006
CONC. FACTOR

DATE EXTRACTED 05/20/84
DATE INJECTED 05/30/84

ANALYST DRL

VERIFIED BY LLN
COMPOUNDS DETECTED 0

NPDES SCAN	EPA	COMPOUND	RESULT	NPDES SCAN	EPA	COMPOUND	RESULT
1P	89P	aldrin	ND	2P	102P	alpha BHC	ND
10P	90P	dieldrin	ND	3P	103P	beta BHC	ND
6P	91P	chlordane	ND	4P	104P	gamma BHC	ND
7P	92P	4,4'-DDT	ND	5P	105P	delta BHC	ND
8P	93P	4,4'-DDE	ND	18P	106P	PCB-1242	ND
9P	94P	4,4'-DDD	ND	19P	107P	PCB-1254	ND
11P	95P	alpha endosulfan	ND	20P	108P	PCB-1221	ND
12P	96P	beta endosulfan	ND	21P	109P	PCB-1232	ND
14P	97P	endosulfan sulfate	ND	22P	110P	PCB-1248	ND
14P	98P	endrin	ND	23P	111P	PCB-1260	ND
15P	99P	endrin aldehyde	ND	24P	112P	PCB-1016	ND
16P	100P	heptachlor	ND	25P	113P	toxaphene	ND
17P	101P	heptachlor epoxide	ND				

RADIAN CORPORATION

RECEIVED: 05/11/84

Analytical Serv REPORT
Results by Sample

LAB # 84-05-059
Continued From Above

SAMPLE ID A077

FRACTION 04D TEST CODE PESTES NAME EPA 608 Pesticides by EC
Date & Time Collected not specified Category

NOTES AND DEFINITIONS FOR THIS REPORT.

SCAN = scan number on chromatogram.
All results reported in micrograms/liter unless otherwise specified.
ND = not detected at EPA detection limit method 608, (Federal Register, 12/3/79).

RADIAN CORPORATION

RECEIVED: 05/11/84

Analytical Serv REPORT
Results by Sample

LAB # 84-05-059

SAMPLE ID A078 SAMPLE # 05 FRACTIONS: A,B,C,D,E
Date & Time Collected not specified Category

AG_E	<.002 ug/ml	AS_GA	<.002 ug/ml	BA_E	0.12 ug/ml	CD_E	<.002 ug/ml	CR_E	<.001 ug/ml	HG_CA	<.0002 ug/ml
ONG_IR	<1 mg/L	PB_GA	<.002 ug/ml	PHEN_A	0.027 mg/L	SE_GA	<.002 ug/ml	TOC	8 mg/L	TOX_1	<.01 mg/L

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RECEIVED: 05/11/84

Analytical Serv REPORT
Results by Sample

LAB # 84-05-059

SAMPLE ID A078

FRACTION 05D TEST CODE GCXTRA NAME Special GC analysis *
Date & Time Collected not specified Category

DATE EXTRACTED 05/20/84
DATE INJECTED 06/01/84

VERIFIED BY LLN
ANALYST DRL

COMPOUND	RESULT	UNITS
Dibrom	ND	ug/L

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RECEIVED: 05/11/84

Analytical Serv REPORT
Results by Sample

LAB # 84-05-059

SAMPLE ID A078

FRACTION 05D TEST CODE HERBES NAME Herbicides EC
Date & Time Collected not specified Category

DATE EXTRACTED 05/25/84
CONCENTRATION FACTOR

DATE INJECTED 06/06/84
ANALYST DRL

VERIFIED BY LLN

COMPOUND	RESULT	DET. LIMIT	OTHER HERBICIDES	RESULT	DET. LIMIT
2,4-D	<.1				
2,4,5-TP (Silvex)	<.1				

NOTES AND DEFINITIONS FOR THIS REPORT.
ND = not detected at the specified detection limit.
All results reported in micrograms/liter unless otherwise specified.

PAGE 23 Analytical Serv REPORT LAB # 84-05-059
RECEIVED 05/11/84 Results by Sample

SAMPLE ID A078 FRACTION 05D TEST CODE PESTES NAME EPA 608 Pesticides by EC
Date & Time Collected not specified Category

DATA FILE 214060102 DATE EXTRACTED 05/20/84 ANALYST DRL VERIFIED BY LLN
CONC FACTOR DATE INJECTED 06/01/84 COMPOUNDS DETECTED 0

NPDES SCAN	EPA	COMPOUND	RESULT	NPDES SCAN	EPA	COMPOUND	RESULT
1P	89P	aldrin	ND	2P	102P	alpha BHC	ND
10P	90P	dieldrin	ND	3P	103P	beta BHC	ND
6P	91P	chlordane	ND	4P	104P	gamma BHC	ND
7P	92P	4,4'-DDT	ND	5P	105P	delta BHC	ND
8P	93P	4,4'-DDE	ND	18P	106P	PCB-1242	ND
9P	94P	4,4'-DDD	ND	19P	107P	PCB-1254	ND
11P	95P	alpha endosulfan	ND	20P	108P	PCB-1221	ND
12P	96P	beta endosulfan	ND	21P	109P	PCB-1232	ND
14P	97P	endosulfan sulfate	ND	22P	110P	PCB-1248	ND
14P	98P	endrin	ND	23P	111P	PCB-1260	ND
15P	99P	endrin aldehyde	ND	24P	112P	PCB-1016	ND
16P	100P	heptachlor	ND	25P	113P	toxaphene	ND
17P	101P	heptachlor epoxide	ND				

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RECEIVED: 05/11/84

Analytical Serv REPORT
Results by Sample

LAB # 84-05-059
Continued From Above

SAMPLE ID A078

FRACTION 05D TEST CODE PESTES NAME EPA 608 Pesticides by EC
Date & Time Collected not specified Category

NOTES AND DEFINITIONS FOR THIS REPORT.
SCAN = scan number on chromatogram.
All results reported in micrograms/liter unless otherwise specified.
ND = not detected at EPA detection limit method 608, (Federal Register, 12/3/79).

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RECEIVED: 05/11/84

Analytical Serv REPORT
Results by Sample

LAB # 84-05-059

SAMPLE ID A079

SAMPLE # 06 FRACTIONS: A,B,C,D,E
Date & Time Collected not specified Category

AG_E <.002 ug/ml	AS_GA <.002 ug/ml	BA_E 0.11 ug/ml	CD_E <.002 ug/ml	CR_E <.001 ug/ml	HG_CA <.0002 ug/ml
ONG_IR <1 mg/L	PB_GA 0.006 ug/ml	PHEN_A 0.022 mg/L	SE_GA <.002 ug/ml	TOC 11 mg/L	TOX_1 <.01 mg/L

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CORPORATION

PAGE 28
RECEIVED: 05/11/84

Analytical Serv REPORT
Results by Sample

LAB # 84-05-059

SAMPLE ID A079

FRACTION 06D TEST CODE GCXTRA NAME Special GC analysis *
Date & Time Collected not specified Category

DATE EXTRACTED 05/20/84
DATE INJECTED 06/01/84

VERIFIED BY LLN
ANALYST DRL

COMPOUND	RESULT	UNITS
Dibrom	ND	ug/L

RADIAN CORPORATION

RECEIVED: 05/11/84

Analytical Serv REPORT
Results by Sample

LAB # 84-05-059

SAMPLE ID A079

FRACTION 06D TEST CODE HERBES NAME Herbicides EC
Date & Time Collected not specified Category

DATE EXTRACTED 05/25/84
CONCENTRATION FACTOR

DATE INJECTED 06/06/84
ANALYST DRL

VERIFIED BY LLN

COMPOUND	RESULT	DET. LIMIT	OTHER HERBICIDES	RESULT	DET. LIMIT
2,4-D	<.1				
2,4,5-TP (Silvex)	<.1				

NOTES AND DEFINITIONS FOR THIS REPORT.
ND = not detected at the specified detection limit.
All results reported in micrograms/liter unless otherwise specified.

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PAGE 30 Analytical Serv REPORT LAB # 84-05-059
RECEIVED: 05/11/84 Results by Sample

SAMPLE ID A079 FRACTION 06D TEST CODE PESTES NAME EPA 608 Pesticides by EC
Date & Time Collected not specified Category

DATA FILE 214060103 DATE EXTRACTED 05/20/84 ANALYST DRL VERIFIED BY LLN
CONC. FACTOR DATE INJECTED 06/01/84 COMPOUNDS DETECTED 0

NPDES SCAN	EPA	COMPOUND	RESULT	NPDES SCAN	EPA	COMPOUND	RESULT
1P	89P	aldrin	ND	2P	102P	alpha BHC	ND
10P	90P	dieldrin	ND	3P	103P	beta BHC	ND
6P	91P	chlordane	ND	4P	104P	gamma BHC	ND
7P	92P	4,4'-DDT	ND	5P	105P	delta BHC	ND
8P	93P	4,4'-DDE	ND	18P	106P	PCB-1242	ND
9P	94P	4,4'-DDD	ND	19P	107P	PCB-1254	ND
11P	95P	alpha endosulfan	ND	20P	108P	PCB-1221	ND
12P	96P	beta endosulfan	ND	21P	109P	PCB-1232	ND
14P	97P	endosulfan sulfate	ND	22P	110P	PCB-1248	ND
14P	98P	endrin	ND	23P	111P	PCB-1260	ND
15P	99P	endrin aldehyde	ND	24P	112P	PCB-1016	ND
16P	100P	heptachlor	ND	25P	113P	toxaphene	ND
17P	101P	heptachlor epoxide	ND				

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RECEIVED: 05/11/84

Analytical Serv REPORT
Results by Sample

LAB # 84-05-059
Continued From Above

SAMPLE ID A079

FRACTION 06D TEST CODE PESTES NAME EPA 608 Pesticides by EC
Date & Time Collected not specified Category

NOTES AND DEFINITIONS FOR THIS REPORT.
SCAN = scan number on chromatogram.
All results reported in micrograms/liter unless otherwise specified.
ND = not detected at EPA detection limit method 608. (Federal Register, 12/3/79).

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RECEIVED: 05/11/84

Analytical Serv REPORT
Results by Sample

LAB # 84-05-059

SAMPLE ID A080

SAMPLE # 07 FRACTIONS: A, B, C, D, E
Date & Time Collected not specified Category

AG_E	<.002 ug/ml	AS_GA	<.002 ug/ml	BA_E	0.083 ug/ml	CD_E	<.002 ug/ml	CR_E	<.001 ug/ml	HG_CA	<.0002 ug/ml
ONG_IR	<1 mg/L	PB_GA	0.006 ug/ml	PHEN_A	0.046 mg/L	SE_GA	<.002 ug/ml	TOC	22 mg/L	TOX_1	<.01 mg/L

RADIAN CORPORATION

RECEIVED: 05/11/84

Analytical Serv REPORT
Results by Sample

LAB # 84-05-059

SAMPLE ID A080

FRACTION 07D TEST CODE GCXTRA NAME Special GC analysis *
Date & Time Collected not specified Category

DATE EXTRACTED 05/20/84
DATE INJECTED 06/01/84

VERIFIED BY LLN
ANALYST DRL

COMPOUND	RESULT	UNITS
Dibrom	ND	ug/L

RADIAN CORPORATION

RECEIVED: 05/11/84

Analytical Serv REPORT
Results by Sample

LAB # 84-05-059

SAMPLE ID A080

FRACTION 07D TEST CODE HERBES NAME Herbicides EC
Date & Time Collected not specified Category

DATE EXTRACTED 05/25/84
CONCENTRATION FACTOR

DATE INJECTED 06/06/84
ANALYST DRL

VERIFIED BY LLN

COMPOUND	RESULT	DET. LIMIT	OTHER HERBICIDES	RESULT	DET. LIMIT
2,4-D	<1				
2,4,5-TP (Silvex)	<1				

NOTES AND DEFINITIONS FOR THIS REPORT.
ND = not detected at the specified detection limit.
All results reported in micrograms/liter unless otherwise specified.

RADIAN CORPORATION

RECEIVED: 05/11/84

Analytical Serv REPORT
Results by Sample

LAB # 84-05-059

SAMPLE ID A080

FRACTION 07D TEST CODE PESTES NAME EPA 608 Pesticides by EC
Date & Time Collected not specified Category

DATA FILE 214060104
CONC. FACTOR

DATE EXTRACTED 05/20/84
DATE INJECTED 06/01/84

ANALYST DRL

VERIFIED BY LLN
COMPOUNDS DETECTED 0

NPDES SCAN	EPA	COMPOUND	RESULT	NPDES SCAN	EPA	COMPOUND	RESULT
1P	89P	aldrin	ND	2P	102P	alpha BHC	ND
10P	90P	dieldrin	ND	3P	103P	beta BHC	ND
6P	91P	chlordane	ND	4P	104P	gamma BHC	ND
7P	92P	4,4'-DDT	ND	5P	105P	delta BHC	ND
8P	93P	4,4'-DDE	ND	18P	106P	PCB-1242	ND
9P	94P	4,4'-DDD	ND	19P	107P	PCB-1254	ND
11P	95P	alpha endosulfan	ND	20P	108P	PCB-1221	ND
12P	96P	beta endosulfan	ND	21P	109P	PCB-1232	ND
14P	97P	endosulfan sulfate	ND	22P	110P	PCB-1248	ND
14P	98P	endrin	ND	23P	111P	PCB-1260	ND
15P	99P	endrin aldehyde	ND	24P	112P	PCB-1016	ND
16P	100P	heptachlor	ND	25P	113P	toxaphene	ND
17P	101P	heptachlor epoxide	ND				

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RECEIVED: 05/11/84

Analytical Serv REPORT
Results by Sample

LAB # 84-05-059
Continued From Above

SAMPLE ID A080

FRACTION 07D TEST CODE PESTES NAME EPA 608 Pesticides by EC
Date & Time Collected not specified Category

NOTES AND DEFINITIONS FOR THIS REPORT.
SCAN = scan number on chromatogram.
All results reported in micrograms/liter unless otherwise specified.
ND = not detected at EPA detection limit method 608. (Federal Register, 12/3/79).

CORPORATION

PAGE 1 — Analytical Serv REPORT — LAB # 85-02-155

RECEIVED: 02/22/85 — 03/25/85 12:57:40

REPORT TO: Radian
Bl. 4
Austin

ATTEN: Tom Grimshaw

CLIENT: BERGSTROM — SAMPLES 21
COMPANY: Bergstrom AFB
FACILITY:

WORK ID: soils for SW8020
TAKEN: PAW
TRANS: PAW
TYPE:
P.O. #: 212-027-11-75
INVOICE: under separate cover

PREPARED BY: Radian Analytical Services
8501 MoPac Blvd
P.O. Box 9948
Austin, Texas 78766

ATTEN:
PHONE: (512) 454-4797

CERTIFIED BY

CONTACT: CONOVER

Note: Detection limit for SW8020 was 150 ug/Kg.

Footnotes and Comments

* Indicates a value less than 5 times the detection limit. Potential error for such low values ranges between 50 and 100%.

@ Indicates that spike recovery for this analysis on the specific matrix was not within acceptable limits indicating an interferent present.

H-86

SAMPLE IDENTIFICATION

01 A081
02 A082
03 A083
04 A084
05 A085
06 A086
07 A087
08 A088
09 A089
10 A090
11 A091
12 A092
13 A093
14 A094
15 A095
16 A096
17 A097

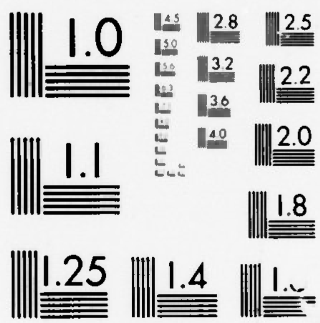
Analytical Serv TEST CODES and NAMES used on this report

SW8020 GC-PID Arom. Vol. - SW846

RECEIVED: 02/22/85 03/25/85 12:57:40

SAMPLE IDENTIFICATION

17 A097
18 A098
19 A099
20 A100
21 A090 QC



MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

CORPORATION

RECEIVED: 02/22/85

Analytical Serv REPORT
Results by Sample

LAB # 85-02-155

SAMPLE ID A081 FRACTION 01A TEST CODE SW8020 NAME GC-PID Arom. Vol. - SW846
Date & Time Collected 02/20/85 Category

DATA FILE D
CONC. FACTOR

DATE INJECTED 03/06/85

ANALYST MCL
INSTRUMENT d

VERIFIED BY JSG
COMPOUNDS DETECTED 0

SCAN	COMPOUND	RESULT	SCAN	COMPOUND	RESULT
	Benzene	ND		1,3-Dichlorobenzene	ND
	Toluene	ND		1,2-Dichlorobenzene	ND
	Ethyl Benzene	ND		1,4-Dichlorobenzene	ND

NOTES AND DEFINITIONS FOR THIS REPORT.
SCAN = scan number or retention time on chromatogram.
All results reported in ug/Kg unless otherwise specified.
ND = not detected at detection limit of 1 ug/kg, unless otherwise specified.

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CORPORATION

PAGE 4 | Analytical Serv REPORT | LAB # 85-02-155

RECEIVED: 02/22/85 | Results by Sample

SAMPLE ID A082 FRACTION 02A TEST CODE SW8020 NAME GC-PID Arom. Vol. - SW846

Date & Time Collected 02/20/85 Category

DATA FILE D DATE INJECTED 03/06/85 ANALYST MCL VERIFIED BY JSG

CONC. FACTOR INSTRUMENT d COMPOUNDS DETECTED 0

SCAN	COMPOUND	RESULT	SCAN	COMPOUND	RESULT
____	Benzene	ND	____	1,3-Dichlorobenzene	ND
____	Toluene	ND	____	1,2-Dichlorobenzene	ND
____	Ethyl Benzene	ND	____	1,4-Dichlorobenzene	ND

NOTES AND DEFINITIONS FOR THIS REPORT.

SCAN = scan number or retention time on chromatogram.

All results reported in ug/Kg unless otherwise specified

ND = not detected at detection limit of 1 ug/kg, unless otherwise specified.

CORPORATION

PAGE 5
RECEIVED: 02/22/85

Analytical Serv REPORT
Results by Sample

LAB # 85-02-155

SAMPLE ID A083 FRACTION 03A TEST CODE SW8020 NAME GC-PID Arom. Vol. - SW846
Date & Time Collected 02/20/85 Category

DATA FILE D DATE INJECTED 03/06/85 ANALYST MCL VERIFIED BY JSG
CONC. FACTOR INSTRUMENT d COMPOUNDS DETECTED 0

SCAN	COMPOUND	RESULT	SCAN	COMPOUND	RESULT
	Benzene	ND		1,3-Dichlorobenzene	ND
	Toluene	ND		1,2-Dichlorobenzene	ND
	Ethyl Benzene	ND		1,4-Dichlorobenzene	ND

NOTES AND DEFINITIONS FOR THIS REPORT.
SCAN = scan number or retention time on chromatogram.
All results reported in ug/Kg unless otherwise specified
ND = not detected at detection limit of 1 ug/kg, unless otherwise specified.

CORPORATION

RECEIVED: 02/22/85

Analytical Serv REPORT
Results by Sample

LAB # 85-02-155

SAMPLE ID A084 FRACTION 04A TEST CODE SW8020 NAME GC-PID Arom. Vol. - SW846
Date & Time Collected 02/20/85 Category

DATA FILE D
CONC. FACTOR

DATE INJECTED 03/06/85

ANALYST MCL
INSTRUMENT d

VERIFIED BY JSG
COMPOUNDS DETECTED 0

SCAN	COMPOUND	RESULT	SCAN	COMPOUND	RESULT
	Benzene	ND		1,3-Dichlorobenzene	ND
	Toluene	ND		1,2-Dichlorobenzene	ND
	Ethyl Benzene	ND		1,4-Dichlorobenzene	ND

NOTES AND DEFINITIONS FOR THIS REPORT
SCAN = scan number or retention time on chromatogram.
All results reported in ug/Kg unless otherwise specified
ND = not detected at detection limit of 1 ug/kg, unless otherwise specified.

CORPORATION

RECEIVED: 02/22/85

Analytical Serv REPORT
Results by Sample

LAB # 85-02-155

SAMPLE ID A085 FRACTION 05A TEST CODE SW8020 NAME GC-PID Arom. Vol. - SW846
Date & Time Collected 02/20/85 Category

DATA FILE D DATE INJECTED 03/06/85 ANALYST MCL VERIFIED BY JSG
CONC. FACTOR INSTRUMENT d COMPOUNDS DETECTED 0

SCAN	COMPOUND	RESULT	SCAN	COMPOUND	RESULT
	Benzene	ND		1,3-Dichlorobenzene	ND
	Toluene	ND		1,2-Dichlorobenzene	ND
	Ethyl Benzene	ND		1,4-Dichlorobenzene	ND

NOTES AND DEFINITIONS FOR THIS REPORT.
SCAN = scan number or retention time on chromatogram.
All results reported in ug/Kg unless otherwise specified
ND = not detected at detection limit of 1 ug/kg, unless otherwise specified.

CORPORATION

RECEIVED: 02/22/85

Analytical Serv REPORT
Results by Sample

LAB # 85-02-155

SAMPLE ID A086

FRACTION 06A TEST CODE SW8020 NAME GC-PID Arom. Vol. - SW846
Date & Time Collected 02/20/85 Category

DATA FILE D
CONC. FACTOR

DATE INJECTED 03/06/85

ANALYST RAA
INSTRUMENT d

VERIFIED BY JSG
COMPOUNDS DETECTED 0

SCAN	COMPOUND	RESULT	SCAN	COMPOUND	RESULT
___	Benzene	ND	___	1,3-Dichlorobenzene	ND
___	Toluene	ND	___	1,2-Dichlorobenzene	ND
___	Ethyl Benzene	ND	___	1,4-Dichlorobenzene	ND

NOTES AND DEFINITIONS FOR THIS REPORT.
SCAN = scan number or retention time on chromatogram.
All results reported in ug/Kg unless otherwise specified
ND = not detected at detection limit of 1 ug/kg, unless otherwise specified.

CORPORATION

PAGE 9 Analytical Serv REPORT LAB # 85-02-155

RECEIVED: 02/22/85 Results by Sample

SAMPLE ID A087 FRACTION 07A TEST CODE SW8020 NAME GC-PID Arom. Vol. - SW846

Date & Time Collected 02/20/85 Category

DATA FILE D DATE INJECTED 03/06/85 ANALYST D VERIFIED BY JSG

CONC. FACTOR INSTRUMENT raa COMPOUNDS DETECTED 0

SCAN	COMPOUND	RESULT	SCAN	COMPOUND	RESULT
	Benzene	ND		1,3-Dichlorobenzene	ND
	Toluene	ND		1,2-Dichlorobenzene	ND
	Ethyl Benzene	ND		1,4-Dichlorobenzene	ND

NOTES AND DEFINITIONS FOR THIS REPORT.

SCAN = scan number or retention time on chromatogram.

All results reported in ug/Kg unless otherwise specified.

ND = not detected at detection limit of 1 ug/kg, unless otherwise specified.

CORPORATION

RECEIVED: 02/22/85

Analytical Serv REPORT
Results by Sample

LAB # 85-02-155

SAMPLE ID A088

FRACTION 08A TEST CODE SW8020 NAME GC-PID Arom. Vol. - SW846
Date & Time Collected 02/20/85 Category

DATA FILE D
CONC. FACTOR

DATE INJECTED 03/06/85

ANALYST RAA
INSTRUMENT d

VERIFIED BY JSG
COMPOUNDS DETECTED 0

SCAN	COMPOUND	RESULT	SCAN	COMPOUND	RESULT
	Benzene	ND		1,3-Dichlorobenzene	ND
	Toluene	ND		1,2-Dichlorobenzene	ND
	Ethyl Benzene	ND		1,4-Dichlorobenzene	ND

NOTES AND DEFINITIONS FOR THIS REPORT.
SCAN = scan number or retention time on chromatogram.
All results reported in ug/Kg unless otherwise specified.
ND = not detected at detection limit of 1 ug/kg, unless otherwise specified.

CORPORATION

RECEIVED: 02/22/85

Analytical Serv REPORT
Results by Sample

LAB # 85-02-155

SAMPLE ID A089 FRACTION 09A TEST CODE SW8020 NAME GC-PID Arom. Vol. - SW846
Date & Time Collected 02/20/85 Category

DATA FILE D DATE INJECTED 03/06/85 ANALYST RAA VERIFIED BY JSG
CONC. FACTOR INSTRUMENT d COMPOUNDS DETECTED 0

SCAN	COMPOUND	RESULT	SCAN	COMPOUND	RESULT
	Benzene	ND		1,3-Dichlorobenzene	ND
	Toluene	ND		1,2-Dichlorobenzene	ND
	Ethyl Benzene	ND		1,4-Dichlorobenzene	ND

NOTES AND DEFINITIONS FOR THIS REPORT.
SCAN = scan number or retention time on chromatogram.
All results reported in ug/Kg unless otherwise specified
ND = not detected at detection limit of 1 ug/kg, unless otherwise specified.

CORPORATION

RECEIVED: 02/22/85

Analytical Serv REPORT
Results by Sample

LAB # 85-02-155

SAMPLE ID A090

FRACTION 10A TEST CODE SW8020 NAME GC-PID Arom. Vol. - SW846
Date & Time Collected 02/20/85 Category

DATA FILE D
CONC. FACTOR

DATE INJECTED 03/06/85

ANALYST RAA
INSTRUMENT d

VERIFIED BY JSG
COMPOUNDS DETECTED 0

SCAN	COMPOUND	RESULT	SCAN	COMPOUND	RESULT
	Benzene	ND		1,3-Dichlorobenzene	ND
	Toluene	ND		1,2-Dichlorobenzene	ND
	Ethyl Benzene	ND		1,4-Dichlorobenzene	ND

NOTES AND DEFINITIONS FOR THIS REPORT.
SCAN = scan number or retention time on chromatogram.
All results reported in ug/Kg unless otherwise specified
ND = not detected at detection limit of 1 ug/kg, unless otherwise specified.

CORPORATION

PAGE 13 Analytical Serv REPORT LAB # 85-02-155

RECEIVED: 02/22/85 Results by Sample

SAMPLE ID A091 FRACTION 11A TEST CODE SW8020 NAME GC-PID Arom. Vol. - SW846

Date & Time Collected 02/20/85 Category ________

DATA FILE ________ D DATE INJECTED 03/06/85 ANALYST ____ RAA VERIFIED BY JSG

CONC. FACTOR ________ INSTRUMENT ____ d COMPOUNDS DETECTED 0

SCAN	COMPOUND	RESULT	SCAN	COMPOUND	RESULT
____	Benzene	ND	____	1,3-Dichlorobenzene	ND
____	Toluene	ND	____	1,2-Dichlorobenzene	ND
____	Ethyl Benzene	ND	____	1,4-Dichlorobenzene	ND

NOTES AND DEFINITIONS FOR THIS REPORT.

SCAN = scan number or retention time on chromatogram.

All results reported in ug/Kg unless otherwise specified.

ND = not detected at detection limit of 1 ug/kg, unless otherwise specified.

CORPORATION

RECEIVED: 02/22/85

Analytical Serv REPORT
Results by Sample

LAB # 85-02-155

SAMPLE ID A092

FRACTION 12A TEST CODE SW8020 NAME GC-PID Arom. Vol. - SW846

Date & Time Collected 02/20/85 Category

DATA FILE D
CONC. FACTOR

DATE INJECTED 03/06/85

ANALYST RAA
INSTRUMENT d

VERIFIED BY JSG
COMPOUNDS DETECTED 0

SCAN	COMPOUND	RESULT	SCAN	COMPOUND	RESULT
	Benzene	ND		1,3-Dichlorobenzene	ND
	Toluene	ND		1,2-Dichlorobenzene	ND
	Ethyl Benzene	ND		1,4-Dichlorobenzene	ND

NOTES AND DEFINITIONS FOR THIS REPORT.
SCAN = scan number or retention time on chromatogram.
All results reported in ug/Kg unless otherwise specified
ND = not detected at detection limit of 1 ug/kg, unless otherwise specified.

CORPORATION

PAGE 15
RECEIVED: 02/22/85

Analytical Serv REPORT
Results by Sample

LAB # 85-02-155

SAMPLE ID A093

FRACTION 13A TEST CODE SW8020 NAME GC-PID Arom. Vol. - SW846
Date & Time Collected 02/20/85 Category

DATA FILE D
CONC. FACTOR

DATE INJECTED 03/06/85

ANALYST RAA
INSTRUMENT d

VERIFIED BY JSG
COMPOUNDS DETECTED 0

SCAN	COMPOUND	RESULT	SCAN	COMPOUND	RESULT
	Benzene	ND		1,3-Dichlorobenzene	ND
	Toluene	ND		1,2-Dichlorobenzene	ND
	Ethyl Benzene	ND		1,4-Dichlorobenzene	ND

NOTES AND DEFINITIONS FOR THIS REPORT.
SCAN = scan number or retention time on chromatogram.
All results reported in ug/Kg unless otherwise specified
ND = not detected at detection limit of 1 ug/kg, unless otherwise specified.

CORPORATION

RECEIVED: 02/22/85

Analytical Serv REPORT
Results by Sample

LAB # 85-02-155

SAMPLE ID A094 FRACTION 14A TEST CODE SW8020 NAME GC-PID Arom. Vol. - SW846
Date & Time Collected 02/20/85 Category

DATA FILE D
CONC. FACTOR

DATE INJECTED 03/06/85

ANALYST RAA
INSTRUMENT d

VERIFIED BY JSG
COMPOUNDS DETECTED 0

SCAN	COMPOUND	RESULT	SCAN	COMPOUND	RESULT
	Benzene	ND		1,3-Dichlorobenzene	ND
	Toluene	ND		1,2-Dichlorobenzene	ND
	Ethyl Benzene	ND		1,4-Dichlorobenzene	ND

NOTES AND DEFINITIONS FOR THIS REPORT.
SCAN = scan number or retention time on chromatogram.
All results reported in ug/Kg unless otherwise specified
ND = not detected at detection limit of 1 ug/kg, unless otherwise specified.

CORPORATION

RECEIVED: 02/22/85

Analytical Serv REPORT
Results by Sample

LAB # 85-02-155

SAMPLE ID A095

FRACTION 15A TEST CODE SW8020 NAME GC-PID Arom. Vol. - SW846
Date & Time Collected 02/20/85 Category

DATA FILE D
CONC. FACTOR

DATE INJECTED 03/07/85

ANALYST MCL
INSTRUMENT d

VERIFIED BY JSG
COMPOUNDS DETECTED 0

SCAN	COMPOUND	RESULT	SCAN	COMPOUND	RESULT
___	Benzene	ND	___	1,3-Dichlorobenzene	ND
___	Toluene	ND	___	1,2-Dichlorobenzene	ND
___	Ethyl Benzene	ND	___	1,4-Dichlorobenzene	ND

NOTES AND DEFINITIONS FOR THIS REPORT.
SCAN = scan number or retention time on chromatogram.
All results reported in ug/Kg unless otherwise specified
ND = not detected at detection limit of 1 ug/kg, unless otherwise specified.

CORPORATION

RECEIVED: 02/22/85

Analytical Serv REPORT
Results by Sample

LAB # 85-02-155

SAMPLE ID A096

FRACTION 16A TEST CODE SW8020 NAME GC-PID Arom. Vol. - SW846
Date & Time Collected 02/20/85 Category

DATA FILE D
CONC. FACTOR

DATE INJECTED 03/07/85

ANALYST MCL
INSTRUMENT d

VERIFIED BY JSG
COMPOUNDS DETECTED 0

SCAN	COMPOUND	RESULT	SCAN	COMPOUND	RESULT
____	Benzene	ND	____	1,3-Dichlorobenzene	ND
____	Toluene	ND	____	1,2-Dichlorobenzene	ND
____	Ethyl Benzene	ND	____	1,4-Dichlorobenzene	ND

NOTES AND DEFINITIONS FOR THIS REPORT.
SCAN = scan number or retention time on chromatogram.
All results reported in ug/Kg unless otherwise specified
ND = not detected at detection limit of 1 ug/kg, unless otherwise specified.

CORPORATION

PAGE 19 Analytical Serv REPORT LAB # 85-02-155
RECEIVED: 02/22/85 Results by Sample

SAMPLE ID A097 FRACTION 17A TEST CODE SW8020 NAME GC-PID Arom. Vol. - SW846
Date & Time Collected 02/21/85 Category

DATA FILE D DATE INJECTED 03/07/85 ANALYST MCL VERIFIED BY JSG
CONC. FACTOR INSTRUMENT d COMPOUNDS DETECTED 0

SCAN	COMPOUND	RESULT	SCAN	COMPOUND	RESULT
	Benzene	ND		1,3-Dichlorobenzene	ND
	Toluene	ND		1,2-Dichlorobenzene	ND
	Ethyl Benzene	ND		1,4-Dichlorobenzene	ND

NOTES AND DEFINITIONS FOR THIS REPORT.
SCAN = scan number or retention time on chromatogram.
All results reported in ug/Kg unless otherwise specified
ND = not detected at detection limit of 1 ug/kg, unless otherwise specified.

CORPORATION

RECEIVED: 02/22/85

Analytical Serv REPORT
Results by Sample

LAB # 85-02-155

SAMPLE ID A098

FRACTION 18A TEST CODE SW8020 NAME GC-PID Arom. Vol. - SW846
Date & Time Collected 02/21/85 Category

DATA FILE D
CONC. FACTOR

DATE INJECTED 03/07/85

ANALYST MCL
INSTRUMENT d

VERIFIED BY JSG
COMPOUNDS DETECTED 0

SCAN	COMPOUND	RESULT	SCAN	COMPOUND	RESULT
	Benzene	ND		1,3-Dichlorobenzene	ND
	Toluene	ND		1,2-Dichlorobenzene	ND
	Ethyl Benzene	ND		1,4-Dichlorobenzene	ND

NOTES AND DEFINITIONS FOR THIS REPORT.
SCAN = scan number or retention time on chromatogram.
All results reported in ug/Kg unless otherwise specified.
ND = not detected at detection limit of 1 ug/kg, unless otherwise specified

CORPORATION

RECEIVED: 02/22/85

Analytical Serv REPORT
Results by Sample

LAB # 85-02-155

SAMPLE ID A099

FRACTION 19A TEST CODE SW8020 NAME GC-PID Arom. Vol. - SW846
Date & Time Collected 02/21/85 Category

DATA FILE D
CONC. FACTOR

DATE INJECTED 03/07/85

ANALYST MCL
INSTRUMENT d

VERIFIED BY JSG
COMPOUNDS DETECTED 0

SCAN	COMPOUND	RESULT	SCAN	COMPOUND	RESULT
	Benzene	ND		1,3-Dichlorobenzene	ND
	Toluene	ND		1,2-Dichlorobenzene	ND
	Ethyl Benzene	ND		1,4-Dichlorobenzene	ND

NOTES AND DEFINITIONS FOR THIS REPORT

SCAN = scan number or retention time on chromatogram.
All results reported in ug/Kg unless otherwise specified
ND = not detected at detection limit of 1 ug/kg, unless otherwise specified.

CORPORATION

RECEIVED: 02/22/85

Analytical Serv REPORT
Results by Sample

LAB # 85-02-155

SAMPLE ID A100 FRACTION 20A TEST CODE SW8020 NAME GC-PID Arom. Vol. - SW846
Date & Time Collected 02/21/85 Category ______

DATA FILE ______D
CONC. FACTOR ______
DATE INJECTED 03/07/85
ANALYST RAA
INSTRUMENT d
VERIFIED BY JSG
COMPOUNDS DETECTED 0

SCAN	COMPOUND	RESULT	SCAN	COMPOUND	RESULT
___	Benzene	ND	___	1,3-Dichlorobenzene	ND
___	Toluene	ND	___	1,2-Dichlorobenzene	ND
___	Ethyl Benzene	ND	___	1,4-Dichlorobenzene	ND

NOTES AND DEFINITIONS FOR THIS REPORT.
SCAN = scan number or retention time on chromatogram.
All results reported in ug/Kg unless otherwise specified
ND = not detected at detection limit of 1 ug/kg, unless otherwise specified.

CORPORATION

 Analytical Serv REPORT LAB # 85-02-155

RECEIVED: 02/22/85 NonReported Work

FRACTION AND TEST CODES FOR WORK NOT REPORTED ELSEWHERE

01B	:	DUP602			
02B	:	DUP602			
03B	:	DUP602			
04B	:	DUP602			
05B	:	DUP602			
06B	:	DUP602			
07B	:	DUP602			
08B	:	DUP602			
09B	:	DUP602			
10B	:	DUP602			
11B	:	DUP602			
12B	:	DUP602			
13B	:	DUP602			
14B	:	DUP602			
15B	:	DUP602			
16B	:	DUP602			
17B	:	DUP602			
18B	:	DUP602			
19B	:	DUP602			
20B	:	DUP602			
21B	:	DUP602	21A	:	LOG_IN

CORPORATION

PAGE 1 Analytical Serv REPORT LAB # 85-02-172
RECEIVED: 02/25/85 03/25/85 13:08:55

REPORT TO Radian
BI 4
Austin

ATTEN Tom Grimshaw

CLIENT BERGSTROM SAMPLES 3
COMPANY Bergstrom AFB
FACILITY

WORK ID MW 2 and 3
TAKEN PAW
TRANS PAW
TYPE
P.O. # 212-027-11-75
INVOICE under separate cover

PREPARED BY Radian Analytical Services
8501 MoPac Blvd
P.O. Box 9948
Austin, Texas 78766
ATTEN
PHONE (512) 454-4797

CERTIFIED BY

CONTACT CONOVER

Footnotes and Comments

* Indicates a value less than 5 times the detection limit. Potential error for such low values ranges between 50 and 100%.

@ Indicates that spike recovery for this analysis on the specific matrix was not within acceptable limits indicating an interferent present.

SAMPLE IDENTIFICATION
01 A103
02 A104
03 A108

Analytical Serv TEST CODES and NAMES used on this report
GC 602 EPA Method 602/GC

CORPORATION

RECEIVED: 02/25/85

Analytical Serv REPORT
Results by Sample

LAB # 85-02-172

SAMPLE ID A103

FRACTION 01A TEST CODE GC 602 NAME EPA Method 602/GC
Date & Time Collected 02/25/85 11:55:00 Category ______

DATA FILE ______D
CONC. FACTOR ______

DATE INJECTED 03/01/85

ANALYST RAA
INSTRUMENT d

VERIFIED BY JSG
COMPOUNDS DETECTED 0

SCAN	COMPOUND	RESULT	SCAN	COMPOUND	RESULT
____	Benzene	ND	____	1,3-Dichlorobenzene	ND
____	Toluene	ND	____	1,2-Dichlorobenzene	ND
____	Ethyl Benzene	ND	____	1,4-Dichlorobenzene	ND

NOTES AND DEFINITIONS FOR THIS REPORT.
SCAN = scan number or retention time on chromatogram.
All results reported in ug/L unless otherwise specified.
ND = not detected at EPA detection limit method 602, (Federal Register, 12/3/79).

CORPORATION

RECEIVED: 02/25/85

Analytical Serv REPORT
Results by Sample

LAB # 85-02-172

SAMPLE ID A104 FRACTION 02A TEST CODE GC 602 NAME EPA Method 602/GC
Date & Time Collected 02/25/85 12:30:00 Category

DATA FILE D
CONC. FACTOR

DATE INJECTED 03/01/85

ANALYST RAA
INSTRUMENT d

VERIFIED BY JSG
COMPOUNDS DETECTED 0

SCAN	COMPOUND	RESULT	SCAN	COMPOUND	RESULT
___	Benzene	ND	___	1,3-Dichlorobenzene	ND
___	Toluene	ND	___	1,2-Dichlorobenzene	ND
___	Ethyl Benzene	ND	___	1,4-Dichlorobenzene	ND

NOTES AND DEFINITIONS FOR THIS REPORT.
SCAN = scan number or retention time on chromatogram.
All results reported in ug/L unless otherwise specified.
ND = not detected at EPA detection limit method 602, (Federal Register, 12/3/79).

RECEIVED: 02/25/85 NonReported Work

FRACTION AND TEST CODES FOR WORK NOT REPORTED ELSEWHERE

01B : DUP602
02B : DUP602
03A : LOG_IN

FIELD ID NO: A-101
SAMPLE CONTROL NO: 4279-1
SAMPLE TYPE: CANISTER

DATE SAMPLED: 02/25/85
DATE ANALYZED: 03/13/85

COMPOUND	CONCENTRATION (PPBV-C)	CONCENTRATION (UG/M**3)	COMPOUND	CONCENTRATION (PPBV-C)	CONCENTRATION (UG/M**3)
PARAFFINS			PARAFFINS (CONT'D)		
C-2 VOC	8020.0	4638.7	C8 ALKANE	19000.0	11093.1
ISOBUTANE	1760.0	1045.6	C8 ALKANE	5780.0	3374.6
N-BUTANE	7850.0	4663.5	C9 ALKANE	20300.0	11836.0
ISOPENTANE	109000.0	64375.0	C9 ALKANE	63400.0	36965.5
N-PENTANE	89100.0	52622.1	C9 ALKANE	67800.0	39530.9
NEOHEXANE	200000.0	117519	C9 ALKANE	101000.0	58888.3
CYCLOPENTANE	60200.0	34519.8	C9 ALKANE	92900.0	54165.5
2,3-DIMETHYLBUTANE	221000.0	129856	C9 ALKANE	3710.0	2163.1
ISOHEXANE	768000.0	451274	C9 ALKANE	20400.0	11894.3
3-METHYLPENTANE	849000.0	498869	C9 ALKANE	13200.0	7696.3
N-HEXANE	527000.0	309663	C9 ALKANE	4060.0	2367.2
METHYLCYCLOPENTANE	449000.0	257709	C9 ALKANE	3570.0	2081.5
2,4-DIMETHYLPENTANE	178000.0	104210	C10+ ALKANE	3740.0	2176.7
CYCLOHEXANE	239000.0	137177	C10+ ALKANE	8510.0	4952.9
ISOHEPTANE	854000.0	499977	C10+ ALKANE	12100.0	7042.3
3-METHYLHEXANE	631000.0	368836	C10+ ALKANE	5090.0	2962.4
2,2,4-TRIMETHYLPENTANE	2050.0	1196.9	C10+ ALKANE	7690.0	4475.6
N-HEPTANE	359000.0	209592	C10+ ALKANE	1110.0	646.0
METHYLCYCLOHEXANE	211000.0	120491	C10+ ALKANE	2330.0	1356.1
2,5-DIMETHYLHEXANE	131000.0	76484.0	C10+ ALKANE	3310.0	1926.4
2,3,4-TRIMETHYLPENTANE	18000.0	10509.3	C10+ ALKANE	4220.0	2456.1
3-METHYLHEPTANE	483000.0	281998	C10+ ALKANE	5730.0	3334.9
2,2,5-TRIMETHYLHEXANE	26700.0	17513.4	C10+ ALKANE	4980.0	2898.4
N-OCTANE	183000.0	106844	C10+ ALKANE	6280.0	3655.0
N-NONANE	31400.0	18307.8	C10+ ALKANE	3150.0	1833.3
N-DECANE	11500.0	6693.1	C10+ ALKANE	1790.0	1041.8
N-UNDECANE	2320.0	1348.3	C10+ ALKANE	1590.0	925.4
C7 ALKANE	20600.0	12060.4	C10+ ALKANE	1790.0	1041.8
C7 ALKANE	70600.0	41333.1	C10+ ALKANE	1880.0	1094.2
C7 ALKANE	198000.0	115919	C10+ ALKANE	2250.0	1309.5
C8 ALKANE	40000.0	23353.9	C10+ ALKANE	2140.0	1245.5
C8 ALKANE	57600.0	33629.6	C10+ ALKANE	10000.0	5820.1
C8 ALKANE	32500.0	18975.0			
C8 ALKANE	226000.0	131949	OLEFINS		
C8 ALKANE	43100.0	25163.8			
C8 ALKANE	2400.0	1401.2	2-METHYL-2-BUTENE	2030.0	970.0
C8 ALKANE	13200.0	7706.8	1-HEXENE	2330.0	1337.3
C8 ALKANE	255000.0	148881	T-2-HEXENE	12400.0	7117.1
C8 ALKANE	11400.0	6655.9	C-2-HEXENE	1790.0	1027.4

(A) ARTIFACT COMPOUND - CONCENTRATION NOT USED IN TOTAL NMHC CALCULATIONS.
(B) VARIABLE RECOVERY THROUGH DRYING SYSTEM - CONCENTRATIONS NOT USED IN TOTAL NMHC CALCULATIONS.
(C) CONCENTRATIONS WERE CALCULATED USING VALUES OF 6 FOR THE CARBON NUMBER AND 86 FOR THE MOLECULAR WEIGHT.

UNITS ARE EQUIVALE[illegible]

FIELD ID NO: A-101
SAMPLE CONTROL NO: 4279-1
SAMPLE TYPE: CANISTER

DATE SAMPLED: 02/25/85
DATE ANALYZED: 03/13/85

COMPOUND	CONCENTRATION (PPBV-C)	CONCENTRATION (UG/M**3)
OLEFINS (CONT'D)		
2,4,4-TRIME-1-PENTENE	2320.0	1330.8
1-METHYLCYCLOHEXENE	149000.0	83188.3
1-OCTENE	39500.0	22658.1
C-2-OCTENE	3170.0	1818.4
A-PINENE	9610.0	5353.3
B-PINENE	9220.0	5136.1
1-DECENE	5170.0	2966.7
LIMONENE	8590.0	4785.1
C7 ALKENE	2490.0	1428.7
C7 ALKENE	13600.0	7803.3
C8 ALKENE	73800.0	42333.3
C8 ALKENE	37800.0	21682.9
C8 ALKENE	208000.0	119313
C9 ALKENE	10200.0	5849.8
C9 ALKENE	20800.0	11929.0
C9 ALKENE	34600.0	19843.4
C9 ALKENE	165000.0	94629.0
C9 ALKENE	6690.0	3836.8
C9 ALKENE	29700.0	17033.2
C9 ALKENE	26000.0	14911.2
C10+ ALKENE	9610.0	5514.5
C10+ ALKENE	9560.0	5485.8
C10+ ALKENE	2190.0	1256.7
C10+ ALKENE	22500.0	12911.1
C10+ ALKENE	23000.0	13198.0
C10+ ALKENE	4550.0	2610.9
C10+ ALKENE	6830.0	3919.2
C10+ ALKENE	4290.0	2461.7
TOTAL AROMATICS		
BENZENE	11400.0	6069.2
TOLUENE	23100.0	12430.7
ETHYLBENZENE	48900.0	26550.1
P-XYLENE/M-XYLENE	40500.0	21989.4
O-XYLENE	14200.0	7709.9
ISOPROPYLBENZENE	1860.0	1016.0
N-PROPYLBENZENE	10900.0	5954.0
M-ETHYLTOLUENE	13100.0	7155.8

COMPOUND	CONCENTRATION (PPBV-C)	CONCENTRATION (UG/M**3)
TOTAL AROMATICS (CONT'D)		
P-ETHYLTOLUENE	7190.0	3927.5
1,3,5-TRIMETHYLBENZENE	4340.0	2370.7
O-ETHYLTOLUENE	4600.0	2512.7
T-BUTYLBENZENE	4560.0	2502.9
1,2,4-TRIMETHYLBENZENE	6130.0	3348.5
N-BUTYLBENZENE	3250.0	1783.9
P-DIETHYLBENZENE	7690.0	4220.9
C9 AROMATIC	11400.0	6227.2
C9 AROMATIC	3920.0	2141.3
C9 AROMATIC	4810.0	2627.4
C9 AROMATIC	3980.0	2174.0
C9 AROMATIC	6750.0	3687.1
C10+ AROMATIC	3320.0	1822.3
TOTAL OXYGENATED HC(B)		
1-BUTANOL	73700.0	55840.5
1,4-DIOXANE	1890.0	1702.6
HEXANAL	12300.0	8401.3
UNIDENTIFIED VOC(C)		
UNIDENTIFIED VOC	1280.0	750.4
UNIDENTIFIED VOC	1180.0	691.8
UNIDENTIFIED VOC	2160.0	1266.3
UNIDENTIFIED VOC	2260.0	1324.9
UNIDENTIFIED VOC	3180.0	1864.2
UNIDENTIFIED VOC	26500.0	15535.2
UNIDENTIFIED VOC	4040.0	2368.4
UNIDENTIFIED VOC	27500.0	16121.4
PARAFFINS	8123100.0	4749191
OLEFINS	955340.0	545640
TOTAL AROMATICS	235900.0	128221
TOTAL OXYGENATED HC	87890.0	65944.3(B)
UNIDENTIFIED VOC	68100.0	39922.5(C)
TOTAL NMHC	9382440.0	5462976

(A) ARTIFACT COMPOUND - CONCENTRATION NOT USED IN TOTAL NMHC CALCULATIONS.
(B) VARIABLE RECOVERY THROUGH DRYING SYSTEM - CONCENTRATIONS NOT USED IN TOTAL NMHC CALCULATIONS.
(C) CONCENTRATIONS WERE CALCULATED USING VALUES OF 6 FOR THE CARBON NUMBER AND 86 FOR THE MOLECULAR WEIGHT.

* UNITS ARE EQUIVALENT TO PPM ASSUMING A DENSITY OF 1.

FIELD ID NO: A-105
SAMPLE CONTROL NO: 4279-2
SAMPLE TYPE: CANISTER

DATE SAMPLED: 02/25/85
DATE ANALYZED: 03/12/85

COMPOUND	CONCENTRATION (PPBV-C)	CONCENTRATION (UG/M**3)	COMPOUND	CONCENTRATION (PPBV-C)	CONCENTRATION (UG/M**3)
PARAFFINS					
C-2 VOC	34.4	19.8			
C-3 VOC	20.5	11.8			
ISOBUTANE	8.1	4.8			
N-BUTANE	19.2	11.4			
ISOPENTANE	12.2	7.2			
N-PENTANE	8.8	5.2			
OLEFINS					
B-PINENE	16.2	9.0			
1-DECENE	25.4	14.6			
LIMONENE	12.4	6.9			
C10+ ALKENE	9.7	5.6			
C10+ ALKENE	10.1	5.8			
C10+ ALKENE	12.0	6.9			
TOTAL AROMATICS					
O-ETHYLTOLUENE	43.3	23.7			
ISOBUTYLBENZENE	8.5	4.7			
M-DIETHYLBENZENE	37.[illegible]	20.5			
C10+ AROMATIC	30.4	16.9			
PARAFFINS	103.2	60.2			
OLEFINS	85.8	48.8			
TOTAL AROMATICS	119.9	65.7			
TOTAL NMHC	308.9	174.6			

(A) ARTIFACT COMPOUND - CONCENTRATION NOT USED IN TOTAL NMHC CALCULATIONS.
(B) VARIABLE RECOVERY THROUGH DRYING SYSTEM - CONCENTRATIONS NOT USED IN TOTAL NMHC CALCULATIONS.
(C) CONCENTRATIONS WERE CALCULATED USING VALUES OF 6 FOR THE CARBON NUMBER AND 86 FOR THE MOLECULAR WEIGHT.

UN[illegible] ARE [illegible]IVAL[illegible] TO [illegible] ASSU[illegible] A D[illegible]ITY [illegible]

FIELD ID NO: A-106
SAMPLE CONTROL NO: 4279-3
SAMPLE TYPE: CANISTER

DATE SAMPLED: 02/25/85
DATE ANALYZED: 03/13/85

COMPOUND	CONCENTRATION (PPBV-C)	CONCENTRATION (UG/M**3)	COMPOUND	CONCENTRATION (PPBV-C)	CONCENTRATION (UG/M**3)
PARAFFINS			PARAFFINS (CONT'D)		
C-2 VOC	31.4	18.0	C10+ ALKANE	20.5	11.9
C-3 VOC	21.2	12.2			
ISOBUTANE	6.2	3.7	OLEFINS		
N-BUTANE	17.9	10.6			
ISOPENTANE	12.4	7.3	B-PINENE	17.5	9.7
N-PENTANE	7.5	4.4	LIMONENE	231.0	126.7
ISOHEXANE	5.6	3.3	1-UNDECENE	303.0	173.8
3-METHYLPENTANE	12.6	7.4	C10+ ALKENE	9.7	5.6
N-HEXANE	5.1	3.0	C10+ ALKENE	21.7	12.5
CYCLOHEXANE	1.8	1.0	C10+ ALKENE	175.0	100.4
N-HEPTANE	2.3	1.3	C10+ ALKENE	227.0	130.3
N-DECANE	169.0	98.4	C10+ ALKENE	304.0	174.4
N-UNDECANE	2490.0	1447.1	C10+ ALKENE	436.0	250.2
C7 ALKANE	2.0	1.2	C10+ ALKENE	832.0	477.4
C10+ ALKANE	4.4	2.6	C10+ ALKENE	27.4	15.7
C10+ ALKANE	9.0	5.2	C10+ ALKENE	19.7	11.3
C10+ ALKANE	8.9	5.2	C10+ ALKENE	23.7	13.6
C10+ ALKANE	5.8	3.4			
C10+ ALKANE	11.4	6.6	TOTAL AROMATICS		
C10+ ALKANE	11.0	6.4			
C10+ ALKANE	190.0	111.6	N-PROPYLBENZENE	9.5	5.2
C10+ ALKANE	39.5	23.0	P-ETHYLTOLUENE	9.1	5.0
C10+ ALKANE	162.0	94.3	O-ETHYLTOLUENE	6.0	3.3
C10+ ALKANE	150.0	87.3	1,2,3-TRIMETHYLBENZENE	17.5	9.6
C10+ ALKANE	190.0	110.6	P-ISOPROPYLTOLUENE	13.9	7.6
C10+ ALKANE	314.0	182.8	INDAN	32.0	17.2
C10+ ALKANE	98.3	57.2	INDENE	79.5	42.0
C10+ ALKANE	152.0	88.5	M-DIETHYLBENZENE	70.2	38.5
C10+ ALKANE	463.0	269.5	N-BUTYLBENZENE	45.8	27.3
C10+ ALKANE	111.0	64.6	P-DIETHYLBENZENE	187.0	102.6
C10+ ALKANE	84.9	49.4	C9 AROMATIC	6.5	3.6
C10+ ALKANE	87.0	50.6	C10+ AROMATIC	16.4	9.0
C10+ ALKANE	36.7	21.4	C10+ AROMATIC	165.0	90.6
C10+ ALKANE	63.7	37.1	C10+ AROMATIC	81.8	44.9
C10+ ALKANE	93.7	54.5	C10+ AROMATIC	39.0	21.4
C10+ ALKANE	54.6	31.8	C10+ AROMATIC	93.7	51.4
C10+ ALKANE	39.9	23.2	C10+ AROMATIC	39.1	21.5
C10+ ALKANE	69.3	40.3	C10+ AROMATIC	82.9	45.5
C10+ ALKANE	58.8	34.2	C10+ AROMATIC	101.0	55.4

(A) ARTIFACT COMPOUND - CONCENTRATION NOT USED IN TOTAL NMHC CALCULATIONS.
(B) VARIABLE RECOVERY THROUGH DRYING SYSTEM - CONCENTRATIONS NOT USED IN TOTAL NMHC CALCULATIONS.
(C) CONCENTRATIONS WERE CALCULATED USING VALUES OF 6 FOR THE CARBON NUMBER AND 86 FOR THE MOLECULAR WEIGHT.

* UNITS ARE EQUIVALENT TO PPM ASSUMING A DENSITY OF 1.

FIELD ID NO: A-106
SAMPLE CONTROL NO: 4273-3
SAMPLE TYPE: CANISTER

DATE SAMPLED: 02/25/85
DATE ANALYZED: 03/13/85

COMPOUND	CONCENTRATION (PPBV-C)	CONCENTRATION (UG/M**3)
TOTAL AROMATICS (CONT'D)		
C10+ AROMATIC	398.0	218.5
C10+ AROMATIC	155.0	85.1
C10+ AROMATIC	142.0	77.9
C10+ AROMATIC	95.1	52.2
C10+ AROMATIC	258.0	141.6
C10+ AROMATIC	165.0	90.6
C10+ AROMATIC	165.0	90.6
C10+ AROMATIC	547.0	300.2
C10+ AROMATIC	146.0	80.1
C10+ AROMATIC	133.0	73.0
C10+ AROMATIC	186.0	102.1
C10+ AROMATIC	275.0	150.9
C10+ AROMATIC	92.1	50.6
C10+ AROMATIC	63.6	34.9
C10+ AROMATIC	42.3	23.2
C10+ AROMATIC	609.0	334.3
C10+ AROMATIC	416.0	228.3
C10+ AROMATIC	266.0	146.0
C10+ AROMATIC	688.0	377.6
C10+ AROMATIC	365.0	200.3
C10+ AROMATIC	110.0	60.4
C10+ AROMATIC	163.0	89.5
C10+ AROMATIC	277.0	152.0
C10+ AROMATIC	600.0	329.3
C10+ AROMATIC	400.0	219.6
C10+ AROMATIC	160.0	87.8
C10+ AROMATIC	204.0	112.0
C10+ AROMATIC	125.0	68.6
C10+ AROMATIC	110.0	60.4
C10+ AROMATIC	101.0	55.4
C10+ AROMATIC	59.9	32.9
C10+ AROMATIC	284.0	155.9
C10+ AROMATIC	248.0	136.1
C10+ AROMATIC	192.0	105.4
C10+ AROMATIC	397.0	217.9
C10+ AROMATIC	274.0	150.4
C10+ AROMATIC	97.7	53.6
C10+ AROMATIC	38.7	21.2

COMPOUND	CONCENTRATION (PPBV-C)	CONCENTRATION (UG/M**3)
TOTAL OXYGENATED HC(B)		
1,4-DIOXANE	5.3	4.8
UNIDENTIFIED VOC(C)		
UNIDENTIFIED VOC	7.0	4.1
UNIDENTIFIED VOC	11.2	6.6
UNIDENTIFIED VOC	15.8	9.3
UNIDENTIFIED VOC	21.5	12.6
UNIDENTIFIED VOC	17.8	10.4
UNIDENTIFIED VOC	8.7	5.1
UNIDENTIFIED VOC	28.4	16.6
UNIDENTIFIED VOC	207.0	121.4
PARAFFINS	5314.3	3091.0
OLEFINS	2627.7	1503.6
TOTAL AROMATICS	10148.3	5568.0
TOTAL OXYGENATED HC	5.3	4.8(B)
UNIDENTIFIED VOC	317.4	186.1(C)
TOTAL NMHC	18407.7	10348.8

(A) ARTIFACT COMPOUND - CONCENTRATION NOT USED IN TOTAL NMHC CALCULATIONS.
(B) VARIABLE RECOVERY THROUGH DRYING SYSTEM - CONCENTRATIONS NOT USED IN TOTAL NMHC CALCULATIONS.
(C) CONCENTRATIONS WERE CALCULATED USING VALUES OF 6 FOR THE CARBON NUMBER AND 86 FOR THE MOLECULAR WEIGHT.

UN[illegible] ARE [illegible]IVAL[illegible] TO [illegible] ISSU[illegible] A [illegible]TY C[illegible]

FIELD ID NO: A-107
SAMPLE CONTROL NO: 4279-4
SAMPLE TYPE: CANISTER

DATE SAMPLED: 02/25/85
DATE ANALYZED: 03/12/85

COMPOUND	CONCENTRATION (PPBV-C)	CONCENTRATION (UG/M**3)	COMPOUND	CONCENTRATION (PPBV-C)	CONCENTRATION (UG/M**3)
PARAFFINS					
C-2 VOC	55.0	32.0			
C-3 VOC	46.4	26.6			
ISOBUTANE	78.9	46.3			
N-BUTANE	61.8	36.7			
ISOPENTANE	17.6	10.4			
N-PENTANE	11.1	6.6			
NEOHEXANE	4.4	2.6			
CYCLOPENTANE	3.4	1.9			
2,3-DIMETHYLBUTANE	3.0	1.8			
ISOHEXANE	4.4	2.6			
3-METHYLPENTANE	13.4	7.9			
OLEFINS					
ISOBUTENE + 1-BUTENE	5.1	2.9			
2-METHYL-2-BUTENE	4.8	2.3			
PARAFFINS	299.1	175.3			
OLEFINS	9.9	5.2			
TOTAL NMHC	309.0	180.6			

(A) ARTIFACT COMPOUND - CONCENTRATION NOT USED IN TOTAL NMHC CALCULATIONS.
(B) VARIABLE RECOVERY THROUGH DRYING SYSTEM - CONCENTRATIONS NOT USED IN TOTAL NMHC CALCULATIONS.
(C) CONCENTRATIONS WERE CALCULATED USING VALUES OF 6 FOR THE CARBON NUMBER AND 86 FOR THE MOLECULAR WEIGHT.

* UNITS ARE EQUIVALENT TO PPM ASSUMING A DENSITY OF 1.

RADIAN
CORPORATION

212-027-11

14 May 1987

Cpt. Lee dePersia
U.S. Air Force Occupational and
Environmental Health Laboratory/TSS
Brooks AFB, Texas 78235-5501

RE: F33615-83-D-4001, Order 11, Bergstrom AFB IRP Phase II, Stage 1
Analytical Quality Control Data Results

Dear Cpt. dePersia:

Enclosed is an advance copy of the analytical quality control data retrieved from the archived laboratory files. These data were requested by Modification No. 5 to subject Delivery Order for inclusion into the IRP Phase II Final Report. These data will be incorporated into the final report as an addition to Appendix H - Analytical Data.

As stated in our previous correspondence, the analytical work for this project was originally done in March-May 1984 and February 1985. Under then-current USAFOEHL guidance, no requirements were identified to segregate laboratory-internal quality control data by project or analysis set. The standard laboratory procedures were to log and store all such data by date, machine and/or analytical procedure. Specifically, the Bergstrom AFB IRP samples were often ganged with samples from other clients from chemical analysis. In general, the quality control objectives prevailing in the laboratory in 1984 and 1985 were met for samples analyzed as a complete lot. As we had also stated, the results of a diligent search for client specific data has resulted in a partial data set.

Some minor variations were noted between the analytical data as presented in the previous drafts of the report and the older raw data inspected during this records search. Please note that these are simply reporting errors. For example, several oil and grease values were originally reported as <100 ug/g and 470 ug/g. The archived data reviewed indicates the values should have been <900 and 4700, respectively. A review of all these data by the supervising geologist has concluded that the archived data do not significantly affect the conclusions of the report. Appropriate final report text or table modifications will be made to reflect any changes based upon the archived data.

The gathering of archived data always presents a serious problem when considering the age and volume of such data. Further, the retrieval of quality control data from this time frame was made difficult because of the relocation of the laboratory and corresponding warehoused records.

8501 Mo-Pac Blvd / P.O. Box 9948 / Austin, Texas 78766 / (512) 454-4797

RADIAN
CORPORATION

This set of data, including this cover letter, will be incorporated into the final report. Please feel free to contact William Little or me if you have any questions, or require any further information.

Sincerely,

Rick A. Belan

Rick A. Belan
Project Director

RAB:sg

Attachment

RADIAN CORPORATION

ATTACHMENT 1

Bergstrom AFB

(1.) 8403205-01→04 no changes in report

(2.) 8403208-01→21 no O&G data

	REPORT	DATA
-16 Pb	2.66	2.64

(3.) 8404119-01→06 no Se data

		REPORT	DATA
(GF) AS	-01	<0.003	<0.002
	-02	<0.003	↓
	-03	<0.003	↓
	-04	<0.002	0.009*
(ICP) Ag	-03	<0.002	0.025
TOC	-05	<1	2*
TOX	-01	<0.02	<0.01
	-05	<0.01	0.09*

(4) 84004120 O&G units are not µg/g on report

		REPORT	DATA
O&G	-01	470	4700
	-06	<100	<900
	-09	<100	<900
	-10	1380	13800
	-11	1270	<1000
	-12	<100	<1000

(5) 84050059-01→07

		REPORT	DATA
Pb	-01	<0.002	0.002*
AS	-05	<0.002	0.007*
Pb	-05	<0.002	0.002*
O&G	-03	<0.01	<1

RADIAN
CORPORATION

ATTACHMENT 2

QUALITY CONTROL DATA SUMMARY

Submitted__________

Compiled LAH 11-11-86

Workorder 84 03 205 Client BERGSTROM AFB Units ug/ml

Samples-01-04

PARAMETER	ANALYSIS DATE	CALIBRATION VERIFICATION STDS.			DUPLICATE ANALYSIS				SPIKE RECOVERY					BLANKS
		FOUND	TRUE	%R	SAMP#	SAMP	DUPL	RPD	SAMP#	SSR	SR	SA	%R	
TOC	3-30-84	57	60	95										
oil+grease	3-30-84													0.005g
Pb-GF	4-4-84	0.019	0.018	106										
Cd_ICP	4-4-84	1.06	1.00	106	-04(A)	<0.002	<0.002	NC						
Cr_ICP		1.05	1.00	105	-04(A)	<0.001	<0.001	NC						
Ni_ICP		1.02	1.00	102	-04(A)	0.004*	0.007*	NC						

RPD = [(|S-D|)/((S+D)/2)] x 100
RPD = Relative Percent Difference
NC = Not calculable due to a value less than five times the IDL

SPIKE %R = [(SSR-SR)/SA] x 100
* = Value is less than five times the instrument detection limit
IDL = Instrument Detection Limit

A = Analytical
P = Predigestion
SSR = Spiked Sample Result
SR = Sample Result
SA = Spiked Added

QUALITY CONTROL DATA SUMMARY

Submitted________

Compiled LAH 11-11-86

Workorder 8403308

Client BERGSTROM AFB

Units ug/g

samples -01 → -24 units: ug/ml

— unless otherwise noted —

PARAMETER	ANALYSIS DATE	CALIBRATION VERIFICATION STDS. FOUND	TRUE	%R	DUPLICATE ANALYSIS SAMP#	SAMP	DUPL	RPD	SPIKE RECOVERY SAMP#	SSR	SR	SA	%R	units: ug/ml BLANKS
Pb-GF	4-4-84	0.019	0.018	106	-15(A)	6.8	7.3	7.1						
					-24(A)	2.4	3.5	37						
[illegible]														
Cd-ICP	4-5-84	104	100	104	-01(A)	<0.083	<0.083	NC	-05(A)	37	<0.086	43	86	0.044
		108	100	108	-15(P)	0.19	<0.088	NC						
		100	100	100	-16(P)	<0.076	16	NC						
					-24(P)	<0.055	<0.072	NC						
Cr-ICP		100	100	100	-01(A)	10	9.7	3.0	-05(A)	60	18	48	88	0.073
		104	100	104	-15(P)	14	14	0						
		97	100	97	-16(P)	8.4	21	86						
					-24(P)	6.2	4.5	32						
Ni-ICP		106	100	106	-01(A)	6.2	6.0	3.3	-05(A)	49	9.7	43	91	<0.003
		107	100	107	-15(P)	9.2	9.6	4.2						
		106	100	106	-16(P)	7.2	20	94						
	↓				-24(P)	7.6	6.0	24						
samples -01 → 04, -15 → 24														

RPD = [(|S-D|)/((S+D)/2)] x 100
RPD = Relative Percent Difference
NC = Not calculable due to a value less than five times the IDL

SPIKE %R = [(SSR-SR)/SA] x 100
* = Value is less than five times the instrument detection limit
IDL = Instrument Detection Limit

A = Analytical
P = Predigestion
SSR = Spiked Sample Result
SR = Sample Result
SA = Spiked Added

8403205

DAILY QUALITY CONTROL

RAS GC LAB

DATE: 4-5-84		SPIKED VALUE (ug/L)	ANALYZED VALUE (ug/L)			% RECOVERY		
	INSTRUMENT		B	D	B	B	D	B
	COMPOUND / ANALYST		CL	CL	CL	CL	CL	CL
EPA 601	Chloromethane	16.2	13.4			82		
	Chloroethane	28.1	18.6			66		
	Methylene Chloride	26.3	22.8			87		
	1,1-Dichloroethylene	45.0	43.1			96		
	Trans-1,2-Dichloroethylene	12.5						
	Carbon Tetrachloride	60.0	47.2			79		
	Dichlorobromethane	40.0	42.4			106		
	1,1,2-Trichloroethane	33.8	50.8			150 ⊛		
EPA 602	Benzene	30.7		29.8			97	
	Toluene	4.1		4.8			117	
	Ethylbenzene	11.5		10.5			92	
	P-Xylene	19.1						
	M-Xylene	42.6						
	O-Xylene	10.6						
EPA 608	Aroclor 1242	(ug/g) 58.7		(ug/g)	58.5			91
	Aroclor 1260	56.8			61.1			108

⊛ poor integration

QUALITY CONTROL DATA SUMMARY

Submitted______

Compiled LAH 11-11-86

Workorder X403808

Client BERGSTROM AFB

Units ug/g unless otherwise noted

samples -01→24

units: ug/ml

PARAMETER	ANALYSIS DATE	CALIBRATION VERIFICATION STDS. FOUND	TRUE	%R	DUPLICATE ANALYSIS SAMP#	SAMP	DUPL	RPD	SPIKE RECOVERY SAMP#	SSR	SR	SA	%R	units: ug/ml BLANKS
Cd_ICP	4-5-84	110	100	110	-14(A)	<0.80	<0.80	NC						0.011
Cr_ICP	↓	106	100	106	-14(A)	8.2	11	29						0.016
Ni_ICP	↓	105	100	105	-14(A)	4.8	7.7	46						<0.003
samples -13, -14														

RPD = [(|S-D|)/((S+D)/2)] x 100
RPD = Relative Percent Difference
NC = Not calculable due to a value less than five times the IDL

SPIKE %R = [(SSR-SR)/SA] x 100
* = Value is less than five times the instrument detection limit
IDL = Instrument Detection Limit

A = Analytical
P = Predigestion
SSR = Spiked Sample Result
SR = Sample Result
SA = Spiked Added

QUALITY CONTROL DATA SUMMARY

Submitted ____________

Compiled LAH 11-11-86

Workorder 84 04 119 Client BERGSTROM AFB Units mg/ml

Samples -01→06

PARAMETER	ANALYSIS DATE	CALIBRATION VERIFICATION STDS. FOUND	TRUE	%R	DUPLICATE ANALYSIS SAMP#	SAMP	DUPL	RPD	SPIKE RECOVERY SAMP#	SSR	SR	SA	%R	BLANKS
oil&grease	4-20-84													0.005g
phenol	4-23-84	0.42	0.35	120										
TOC	4-18-84	58	60	97										
TOX	4-18-84	89	100**	89										
Se-H	4-30-84	0.034	0.040	85										
Pb-GF	4-25-84	0.019	0.018	106					-06(A)	0.030	<0.002	0.030	100	
		0.017	0.018	94										
Hg-CV	4-23-84	0.21 ug	0.25 ug	84										
As-H	4-30-84	0.042	0.040	105										
Ag-ICP	4-20-84	—	—	—	-01(A)	<0.002	<0.002	NC						<0.002
Ba-ICP	↓	102	100	102	-01(A)	<0.001	<0.001	NC						<0.001
Cd-ICP	↓	109	100	109	-01(A)	<0.002	<0.002	NC						<0.002
Cr-ICP	↓	158	100	158	-01(A)	0.016	0.017	6.1						<0.001

**- TOX true value for calibration standards is not documented but based on other TOX data in the same time period the true value may be 100 ppm.

RPD = [(|S-D|)/((S+D)/2)] x 100
RPD = Relative Percent Difference
NC = Not calculable due to a value less than five times the IDL

SPIKE %R = [(SSR-SR)/SA] x 100
* = Value is less than five times the instrument detection limit
IDL = Instrument Detection Limit

A = Analytical
P = Predigestion
SSR = Spiked Sample Result
SR = Sample Result
SA = Spiked Added

QUALITY CONTROL DATA SUMMARY

Submitted__________

Compiled LAH 11-11-86

Workorder 84 04 120

Client BERGSTROM AFB

Units ug/g unless otherwise noted

units: ug/ml

PARAMETER	ANALYSIS DATE	CALIBRATION VERIFICATION STDS.			DUPLICATE ANALYSIS				SPIKE RECOVERY					BLANKS
		FOUND	TRUE	%R	SAMP#	SAMP	DUPL	RPD	SAMP#	SSR	SR	SA	%R	
oil+grease	5-9-84				-10(A)	14	13	7.4						O.g.
Pb-GF	4-25-84	0.019	0.018	106										
		0.018	0.018	100										
		0.016	0.018	89										
		- new curve -												
		0.017	0.018	94	-13(A)	251	242	3.6						
Cd-ICP	4-25-84	116	100	116	-02(A)	<0.20	<0.20	NC						
					-11(A)	<0.25	2.4	NC						
					-13(P)	0.73	<0.22	NC						
Cr-ICP		118	100	118	-02(A)	11	12	8.7						
					-11(A)	13	16	21						
					-13(P)	79	12	147						
Ni-ICP		113	100	113	-02(A)	9.8	11	12						
					-11(A)	9.8	12	20						
					-13(P)	8.6	2.4	113						

RPD = [(|S-D|)/((S+D)/2)] x 100
RPD = Relative Percent Difference
NC = Not calculable due to a value less than five times the IDL

SPIKE %R = [(SSR-SR)/SA] x 100
* = Value is less than five times the instrument detection limit
IDL = Instrument Detection Limit

M = matrix
A = Analytical
P = Predigestion
SSR = Spiked Sample Result
SR = Sample Result
SA = Spiked Added

QUAL... CO...L D... SUM...

Submitted__________

Compiled LAH 11-12-86

Workorder 8405 059

samples -01-07

Client BERGSTROM AFB

Units ug/ml

PARAMETER	ANALYSIS DATE	CALIBRATION VERIFICATION STDS. FOUND	TRUE	%R	DUPLICATE ANALYSIS SAMP#	SAMP	DUPL	RPD	SPIKE RECOVERY SAMP#	SSR	SR	SA	%R	BLANKS
Pb	5-16-84	0.080	** 0.018	111					-06(A)	0.039	0.0016*	@ 0.030	110	
As	5-15-84													
Se	5-15-84	0.018	0.020	90										
Hg	5-21-84	0.23 ug	0.25 ug	92	-01(P)	<0.0002	<0.0002	NC	-01(P)	0.0048	<0.0002	0.0050	96	
phenol	5-15-84	0.37	0.35	106	-03(M)	0.009	0.010							
		0.37	0.35	106	-01(M)	0.019	0.013							
oil+grease	5-14-84													0.0069
TOC	5-14-84													
TOX	5-14-84	0.90	1.00	90	-07(M)	<0.01	<0.01	NC						

@ spike added value based on spike %R calculation. (SA was the only unknown value.)

**- the Pb calibration verif. standard was not documented but based on other data analyzed in the same time period and the percent recovery the true value is 0.018 ppm.

For Se: sample -07 was spiked but the true value and recovery was not documented.

RPD = [(IS-DI)/((S+D)/2)] x 100
RPD = Relative Percent Difference
NC = Not calculable due to a value less than five times the IDL

SPIKE %R = [(SSR-SR)/SA] x 100
* = Value is less than five times the instrument detection limit
IDL = Instrument Detection Limit

M = matrix
A = Analytical
P = Predigestion
SSR = Spiked Sample Result
SR = Sample Result
SA = Spiked Added

QUALITY CONTROL DATA SUMMARY

Submitted ____________

Compiled LAH 11-12-86

Workorder 84 05 059

samples -01-07

Client BERGSTROM AFB

Units mg/ml

PARAMETER	ANALYSIS DATE	CALIBRATION VERIFICATION STDS.			DUPLICATE ANALYSIS				SPIKE RECOVERY					BLANKS
		FOUND	TRUE	%R	SAMP#	SAMP	DUPL	RPD	SAMP#	SSR	SR	SA	%R	
Ag-ICP	5-15-84	—	—	—	-01(A)	<0.002	<0.002	NC	-07(A)	—	—	—	—	0.11
		–	–	–										
Ba-ICP		1.02	1.00	102	-01(A)	0.063	0.058	8.3	-07(A)	1.14	0.083	1.00	105	<0.001
		0.54	0.50	108										
Cd-ICP		1.15	1.00	115	-01(A)	<0.002	<0.002	NC	-07(A)	1.16	<0.002	1.00	116	<0.002
		0.59	0.50	100										
Cr-ICP		1.08	1.00	108	-01(A)	<0.001	<0.001	NC	-07(A)	1.08	<0.001	1.00	108	0.050
		0.54	0.50	108										

RPD = [(|S-D|)/((S+D)/2)] x 100
RPD = Relative Percent Difference
NC = Not calculable due to a value less than five times the IDL

SPIKE %R = [(SSR-SR)/SA] x 100
* = Value is less than five times the instrument detection limit
IDL = Instrument Detection Limit

A = Analytical
P = Predigestion
SSR = Spiked Sample Result
SR = Sample Result
SA = Spiked Added

85 02 155

DAILY QUALITY CONTROL
RAS GC LAB

DATE: 3-6-85		SPIKED VALUE (ug/L)	ANALYZED VALUE (ug/L)			% RECOVERY		
	INSTRUMENT		D	B	C	D	B	C
	COMPOUND / ANALYST		CAC	CL	RA	CAC	CL	RA
EPA 601	Chloromethane	16.2		9.0			56	
	Chloroethane	28.1		37.8			134	
	Methylene Chloride	26.3		30.0			114	
	1,1-Dichloroethylene	45.0		56.5			126	
	Trans-1,2-Dichloroethylene	12.5						
	Carbon Tetrachloride	60.0		60.6			101	
	Dichlorobromethane	40.0		47.7			119	
	1,1,2-Trichloroethane	33.8						
EPA 602	Benzene	30.7	29.4			96		
	Toluene	4.1	4.2			102		
	Ethylbenzene	11.5	10.6			92		
	P-Xylene	19.1						
	M-Xylene	42.6						
	O-Xylene	10.6						
EPA 608	Aroclor 1242	(ug/g) 58.7		(ug/g)	59.2			101
	Aroclor 1260	56.8			64.9			114

85 02 155

DAILY QUALITY CONTROL

RAS GC LAB

DATE: 3-7-85		SPIKED VALUE (ug/L)	ANALYZED VALUE (ug/L)			% RECOVERY		
	INSTRUMENT		D	B		D	B	
	COMPOUND / ANALYST		CL	CL		CL	CL	
EPA 601	Chloromethane	16.2		10.2			63	
	Chloroethane	28.1		30.9			110	
	Methylene Chloride	26.3		26.3			100	
	1,1-Dichloroethylene	45.0		52.0			115	
	Trans-1,2-Dichloroethylene	12.5						
	Carbon Tetrachloride	60.0		54.6			91	
	Dichlorobromethane	40.0		43.8			110	
	1,1,2-Trichloroethane	33.8						
EPA 602	Benzene	30.7	32.6			106		
	Toluene	4.1	4.5			110		
	Ethylbenzene	11.5	11.1			96		
	P-Xylene	19.1						
	M-Xylene	42.6						
	O-Xylene	10.6						
EPA 608	Aroclor 1242	(ug/g) 58.7		(ug/g)				
	Aroclor 1260	56.8						

RADIAN CORPORATION

SURROGATE RECOVERIES

SAMPLE ID: 8502155-01
LAB #: A081
INSTRUMENT: Deloris

602/8020
a,a,a-TRIFLUOROTOLUENE: 101

SAMPLE ID: 8502155-02
LAB #: A082
INSTRUMENT: Deloris

602/8020
a,a,a-TRIFLUOROTOLUENE: 102

SAMPLE ID: 8502155-03
LAB #: A083
INSTRUMENT: Deloris

602/8020
a,a,a-TRIFLUOROTOLUENE: 189 *

SAMPLE ID: 8502155-04
LAB #: A084
INSTRUMENT: Deloris

602/8020
a,a,a-TRIFLUOROTOLUENE: 109

SAMPLE ID: 8502155-05
LAB #: A085
INSTRUMENT: Deloris

602/8020
a,a,a-TRIFLUOROTOLUENE: 120

* interference

RADIAN CORPORATION

SURROGATE RECOVERIES

SAMPLE ID: 8503155-06
LAB #: A086
INSTRUMENT: Deloris

602/8020

a,a,a-TRIFLUOROTOLUENE: 134

SAMPLE ID: 8502155-07
LAB #: A087
INSTRUMENT: Deloris

602/8020

a,a,a-TRIFLUOROTOLUENE: 114

SAMPLE ID: 8502155-08
LAB #: A088
INSTRUMENT: Deloris

602/8020

a,a,a-TRIFLUOROTOLUENE: 109

SAMPLE ID: 8502155-09
LAB #: A089
INSTRUMENT: Deloris

602/8020

a,a,a-TRIFLUOROTOLUENE: 104

SAMPLE ID: 8502155-10
LAB #: A090
INSTRUMENT: Deloris

602/8020

a,a,a-TRIFLUOROTOLUENE: 89

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CORPORATION

SURROGATE RECOVERIES

SAMPLE ID: 8502155-11
LAB #: A091
INSTRUMENT: Deloris

602/8020
a,a,a-TRIFLUOROTOLUENE: 107

SAMPLE ID: 8502155-12
LAB #: A092
INSTRUMENT: Deloris

602/8020
a,a,a-TRIFLUOROTOLUENE: 107

SAMPLE ID: 8502155-13
LAB #: A093
INSTRUMENT: Deloris

602/8020
a,a,a-TRIFLUOROTOLUENE: 113

SAMPLE ID: 8502155-14
LAB #: A094
INSTRUMENT: Deloris

602/8020
a,a,a-TRIFLUOROTOLUENE: 97

SAMPLE ID: 8502155-15
LAB #: A095
INSTRUMENT: Deloris

602/8020
a,a,a-TRIFLUOROTOLUENE: 85

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CORPORATION

SURROGATE RECOVERIES

SAMPLE ID: 8502155-16
LAB #: A096
INSTRUMENT: Deloris

602/8020
a,a,a-TRIFLUOROTOLUENE: 88

SAMPLE ID: 8502155-17
LAB #: A097
INSTRUMENT: Deloris

602/8020
a,a,a-TRIFLUOROTOLUENE: 92

SAMPLE ID: 8502155-18
LAB #: A098
INSTRUMENT: Deloris

602/8020
a,a,a-TRIFLUOROTOLUENE: 96

SAMPLE ID: 8502155-19
LAB #: A099
INSTRUMENT: Deloris

602/8020
a,a,a-TRIFLUOROTOLUENE: 95

SAMPLE ID: 8502155-20
LAB #: A100
INSTRUMENT: Deloris

602/8020
a,a,a-TRIFLUOROTOLUENE: 103

RADIAN
CORPORATION

SURROGATE RECOVERIES

SAMPLE ID: 8502155-21
LAB #: AD90 QC
INSTRUMENT: Deloris

602/8020
a,a,a-TRIFLUOROTOLUENE: 107

SAMPLE ID: ____
LAB #: ____
INSTRUMENT: ____

602/8020
a,a,a-TRIFLUOROTOLUENE: ____

SAMPLE ID: ____
LAB #: ____
INSTRUMENT: ____

602/8020
a,a,a-TRIFLUOROTOLUENE: ____

SAMPLE ID: ____
LAB #: ____
INSTRUMENT: ____

602/8020
a,a,a-TRIFLUOROTOLUENE: ____

SAMPLE ID: ____
LAB #: ____
INSTRUMENT: ____

602/8020
a,a,a-TRIFLUOROTOLUENE: ____

VOA SPIKE RESULTS

LAB #8502155-08
SAMPLE ID A088
METHOD EPA8020

UNITS µg/kg

COMPOUND	SPIKED SAMPLE RESULT (SSR)	SAMPLE RESULT (SR)	SPIKE ADDED (SA)	% R
Benzene	30.7		29.4	104
Toluene	7.1		4.2	169 *
Ethyl benzene	11.5		10.6	108
Chlorobenzene				
1,4-Dichlorobenzene				
1,3-Dichlorobenzene				
1,2-Dichlorobenzene				
P-Xylene				
M-Xylene				
O-Xylene				

% R = [(SSR-SR)/SA] x 100

* interference

VOA SPIKE RESULTS

LAB #8E02155-14
SAMPLE ID A094
METHOD EPA 8020

UNITS µg/kg

COMPOUND	SPIKED SAMPLE RESULT (SSR)	SAMPLE RESULT (SR)	SPIKE ADDED (SA)	% R
Benzene	32.4		29.4	110
Toluene	7.2		4.2	171 *
Ethyl benzene	11.6		10.6	109
Chlorobenzene				
1,4-Dichlorobenzene				
1,3-Dichlorobenzene				
1,2-Dichlorobenzene				
P-Xylene				
M-Xylene				
O-Xylene				

% R = [(SSR-SR)/SA] x 100

* interference

VOA DUPLICATE RESULTS

LAB # 8502155-07
SAMPLE ID A087
METHOD EPA 8020

UNITS µg/kg

COMPOUND	SAMPLE RESULT (S)	DUPLICATE RESULT (D)	RPD
Benzene	ND	ND	NC
Toluene			
Ethyl benzene			
Chlorobenzene			
1,4-Dichlorobenzene			
1,3-Dichlorobenzene			
1,2-Dichlorobenzene			
P-Xylene			
M-Xylene			
O-Xylene			

RPD - RELATIVE PERCENT DIFFERENCE

RPD = [|S-D|/((S+D)/2)] x 100

VOA DUPLICATE RESULTS

LAB # 8502155-15
SAMPLE ID A095
METHOD EPA 8020

UNITS µg/kg

COMPOUND	SAMPLE RESULT (S)	DUPLICATE RESULT (D)	RPD
Benzene	ND	ND	NC
Toluene			
Ethyl benzene			
Chlorobenzene			
1,4-Dichlorobenzene			
1,3-Dichlorobenzene			
1,2-Dichlorobenzene			
P-Xylene			
M-Xylene			
O-Xylene			

RPD - RELATIVE PERCENT DIFFERENCE

$$RPD = [|S-D|/((S+D)/2)] \times 100$$

8502172

DAILY QUALITY CONTROL

RAS GC LAB

DATE: 3-1-85		SPIKED VALUE (ug/L)	ANALYZED VALUE (ug/L)			% RECOVERY		
	INSTRUMENT		B	G	G	B	G	B
	COMPOUND / ANALYST		CAC	CAC	CAC	CAC	CAC	CAC
EPA 601	Chloromethane	16.2	10.4	16.1	14.8	64	99	91
	Chloroethane	28.1	30.0	16.7	19.3	107	100	109
	Methylene Chloride	26.3	24.9	27.5	24.5	95	104	93
	1,1-Dichloroethylene	45.0	48.2	64.0	59.8	107	142	133
	Trans-1,2-Dichloroethylene	12.5						
	Carbon Tetrachloride	60.0	50.6	103.3	103.7	84	⊛ 172	⊛ 173
	Dichlorobromethane	40.0	41.2	40.5	41.6	103	101	104
	1,1,2-Trichloroethane	33.8						
EPA 602	Benzene	30.7	D/CAC 30.2			D/CAC 98		
	Toluene	4.1	4.6			112		
	Ethylbenzene	11.5	11.0			95		
	P-Xylene	19.1						
	M-Xylene	42.6						
	O-Xylene	10.6						
EPA 608	Aroclor 1242	(ug/g) 58.7		(ug/g)				
	Aroclor 1260	56.8						

⊛ poor integration

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ATTACHMENT 3

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QC/QA Data Request
Sam• No. 84-04-119

Steve Madden
10/30/86

1) I was unable to find any standard notebooks, instrument log books, or analyst log books (work books) that gave <u>any</u> reference to the work performed in this work order.

2) Pesticides Analysis (608, including PCB's and DDT

   a) I found 9 HP3390 chromatograms related to these analyses (Nos 14-22, inclusive)

      1) No integrator conditions are given, but it is obvious that an attenuation change was made between standard injections, run #14 and run #22

      2) Two standard injections were made: run #14 and run #22 - the first and last injections of the series

         a) They are both logged as "2uL OC Pest Std 0.05 ug/mL"

         b) The column is apparently mixed phase at 105°C (as given an additional page in the folder)

         c) No pesticide ID's are given (I have guessed on one copy)

         d) Xerox copies of the standards are attached

      3) One Method Blank injection was made: run #15

         a) It is logged as "2uL Method Blank 500mL -> five mL"

         b) Xerox copy of this chromatogram is attached

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b) Total QC/QA Data on Pesticides

1) 2 pesticides standard chromatograms

2) 1 annotated pesticide chromatogram (with ID's provided by me)

3) 1 method blank chromatogram

3) Herbicides Analysis (2,4-D and 2,4,5-TP (Silvex)

a) I found 9 HP 3390 chromatograms related to this analysis (runs 23-31 inclusive)

1) No integrater conditions are given

2) One standard injection was made: run #23

a) It is logged as "2uL Herb Std .1 ug/mL"

b) The column is apparently the same as one for pesitcides (mixed phase at 105°C)

c) No herbicides ID's; are given (I have guessed on one copy)

d) A Xerox copy of the standard chromatogram is attached

3) One apparent method blank chromatogram was made: run #24

a) It is logged as "2uL MB-Herb 900mL ->5mL"

b) A Xerox copy of this chromatogram is attached

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b) Total QC/QA data on Herbicides

1) 1 herbicide standard chromatogram

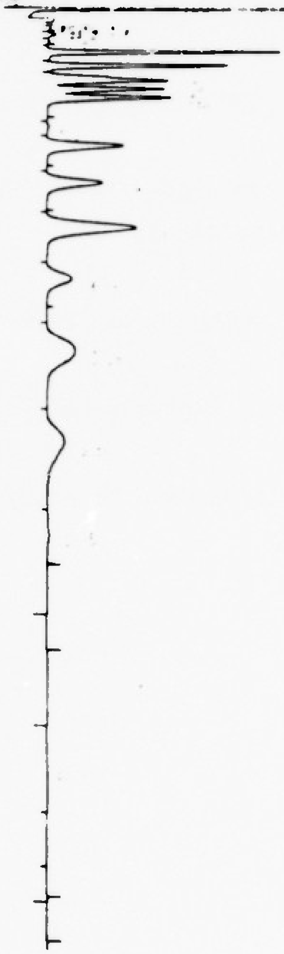
2) 1 annotated herbicides standard chromatogram (with ID's provided by me)

3) 1 method blank chromatogram

4) Naled (Dibrom) Analysis

There is no data of any kind related to this analysis present in the folder.

2ul PESTES STD .05ug/ml



RT	AREA	TYPE	AR/HT	AREA%
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

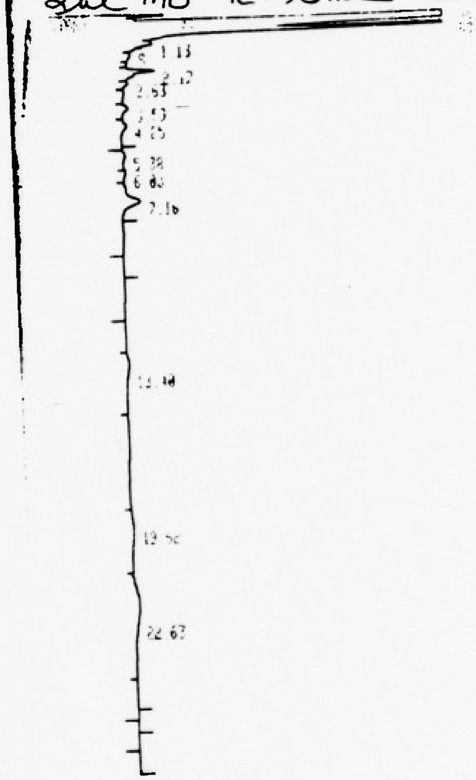
TOTAL AREA = [illegible]
MUL FACTOR = [illegible]

JUN 01 04 [illegible]

RT	AREA	TYPE	AR/HT	AREA%
0.25	1962100	D BB	0.082	5.299
[illegible]	5250	D BP	0.050	0.070
1.[illegible]1	[illegible]	D PV	0.192	0.232
1.[illegible]3	12983	D VP	0.113	0.001
1.[illegible]8	1175400	PB	0.156	[illegible]
2.[illegible]6	1051300	PV	0.12[illegible]	[illegible].813
[illegible]6	1109000	VV	0.227	[illegible]
3.08	952400	VV	0.17[illegible]	[illegible]
[illegible].41	1067200	VB	0.123	[illegible]
[illegible]	15357	BP	[illegible]	0.11[illegible]
[illegible]	944600	PS	0.235	[illegible].004
[illegible]	890330	BB	0.35[illegible]	6.[illegible]
[illegible]	[illegible]	PB	0.457	12.[illegible]
[illegible].13	[illegible]	PB	[illegible]	1.5[illegible]
1[illegible]	1412000	BB	1.046	10.49[illegible]
1[illegible].03	1109600	BV	1.2[illegible]	[illegible]
1[illegible]	168700	VB	1.018	0.2[illegible]
[illegible]	[illegible]	T PB	[illegible]	0.2[illegible]

TOTAL AREA= 1.[illegible]463E+07
MUL FACTOR= 1.0000E+00

2ul MB IL→5ml PEST



STOP

RUN # 201 MAY/30/84 13:23:44
ID 2-1-40530-01

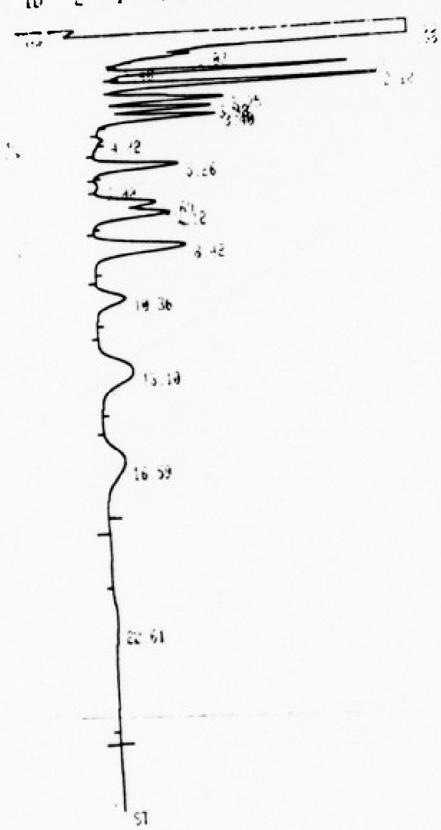
AREA%

RT	AREA	TYPE	AR/HT	AREA%
0.02	14845	D BP	0.048	0.174
0.29	7902400	DSPB	0.006	92.431
0.69	261460	DTBB	0.072	3.058
1.13	12498	DTBB	0.123	0.146
2.17	55842	PV	0.133	0.653
2.63	7922	VP	0.166	6.093
3.59	13393	PV	0.220	0.157
4.25	11445	VB	0.227	0.134
5.38	11971	BV	0.334	0.138
6.03	12040	VV	0.339	0.141
7.16	87412	VB	0.472	1.022
13.40	31950	VP	0.892	0.374
19.62	30302	PV	1.192	0.355
22.63	96839	VV	1.536	1.133

TOTAL AREA= 8549500
MUL FACTOR= 1.0000E+00

5ul Spike Rest 1L→5ml

ID 2-1-40530-029



RUN # 202 MAY/30/84 13:54:06
ID 2-1-40530-02

AREA%

RT	AREA	TYPE	AR/HT	AREA%
0.28	1.6237E+07	SBB	0.143	77.826
0.68	1025100	DIBB	0.075	4.913
1.03	37802	DIBP	0.147	0.131
1.67	269950	TVV	0.109	1.294
2.18	417190	TVV	0.148	2.000
2.75	273190	TVV	0.220	1.309
3.08	193920	TVV	0.172	0.930
3.40	260140	TVP	0.216	1.247
4.22	12763	TPV	0.192	0.061
5.26	256370	TPV	0.290	1.229
6.00	14189	TVV	0.309	0.068
6.69	223370	TVV	0.344	1.071
7.12	276960	TVV	0.360	1.372
8.42	443250	TPV	0.402	2.125
10.36	167520	TPV	0.545	0.803
13.10	391020	TPV	1.195	1.874
16.59	284490	TPB	1.307	1.364
22.61	77231	VP	1.775	0.370

TOTAL AREA= 2.0864E+07
MUL FACTOR= 1.0000E+00

STD .05 ug/ml

RT	AREA
1.68	1058800
2.19	~~417190~~ ~~55842~~ 978490
2.76	1123600
3.08	846300
3.40	1024500
5.26	901120
6.70	821210
8.43	1718200
10.38	570360
13.10	1274300

Spike .05 ug/ml 1L → 5 ml

RT	AREA
1.68	269950

$$\left(\frac{.1\,ng}{2\,ul}\right)\left(\frac{5\,ml}{1000\,ml}\right)\left(\frac{269950}{1058800}\right) = .00006\ ppm$$

.06 ppb

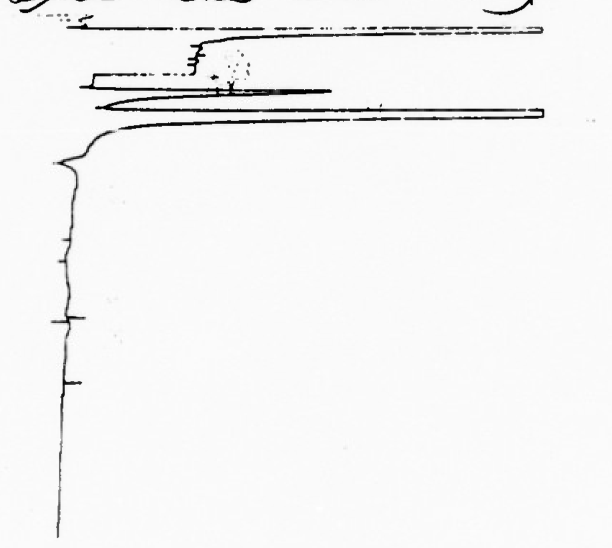
120% Recovery

2.18 417190

$$\left(\frac{.1ng}{2ul}\right)\left(\frac{5ml}{1000ml}\right)\left(\frac{417190-55842}{978490}\right) = .00009\,ppm$$

.09 ppb
180% Recovery

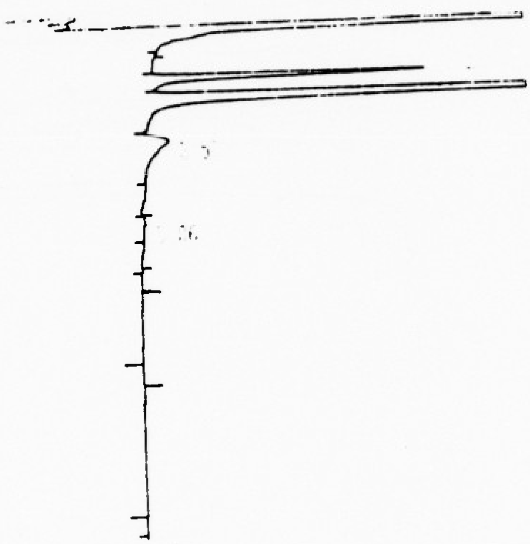
2ul HERB STD 0.1ug/ml



RT	AREA	TYPE	AR/HT	AREA%
[illegible]	10850	BP	0.125	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	BV	0.214	[illegible]
[illegible]	2171300	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	PV	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	BB	0.428	[illegible]

[illegible]

2ul HERB STD 0.1ug/ml

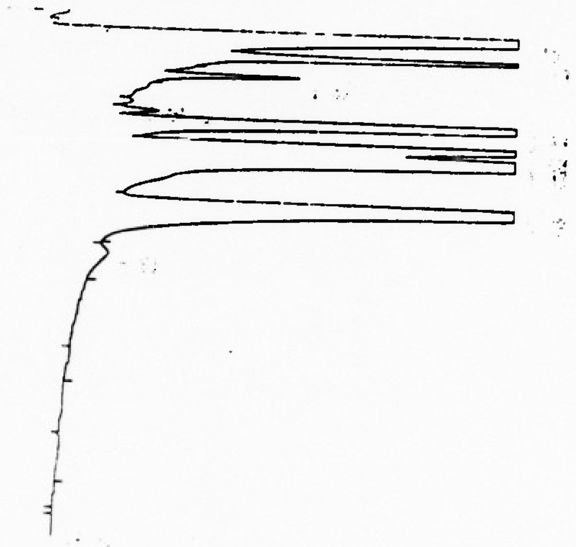


[illegible] 23   JUN 02/84 08:[illegible]
[illegible]-1-4460?-01

RT	AREA	TYPE	AR/HT	AREA%
[illegible]	[illegible]	SPB	0.151	75.529
[illegible]	278830	TBV	0.109	3.[illegible]
[illegible]	1426400	[illegible]	0.146	18.906
[illegible]	113010	TPV	0.375	1.073
[illegible]	13108	TPV	0.429	0.179

TOTAL AREA= [illegible]2400
MUL FACTOR= 1.0000E+00

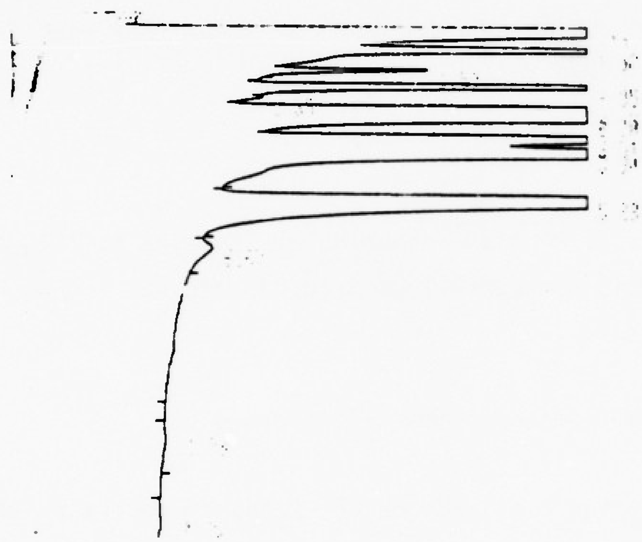
2ul MB 1L→5ml



RT	AREA	TYPE	AR/HT	AREA%
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	0.118	2.77[illegible]
[illegible]	[illegible]	[illegible]	0.111	[illegible]
[illegible]	33155	[illegible]	0.112	0.040
[illegible]	[illegible]	[illegible]	0.115	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	15.2[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	0.012

TOTAL AREA= 1.[illegible]E+08
MUL FACTOR= 1.0000E+00

2ul HERB SPIKE 10ug/ml
1L → 5ml



[illegible] JUN/06/84 14:53:[illegible]
[illegible] -4646-43

RT	AREA	TYPE	AR/HT	AREA%
[illegible]	9294	D BP	0.125	0.405
[illegible]	4.2556E+07	SPB	0.064	21.273
[illegible]	4542300	TBP	0.128	2.292
[illegible]	1050200	TPV	0.111	0.537
[illegible]	1.1526E+07	SBB	0.183	5.792
[illegible]	48849	DTBS	0.104	0.025
[illegible]	3.2766E+07	SBB	0.183	16.737
[illegible]	5.8737E+07	SBB	0.536	30.024
[illegible]	8214400	TBV	0.239	4.129
[illegible]	1.6909E+07	TVP	0.276	8.543
[illegible]	1.3036E+07	TPV	0.353	10.137
[illegible]	361000	TVB	0.452	0.185
11.30	125000	TVB	0.804	0.963
[illegible]	65354	TBB	0.682	0.033

TOTAL AREA= 1.3564E+08
MUL FACTOR= 1.0000E+00

RADIAN CORPORATION

QC/QA Data Request

Sam* No. 84-05-059

Steve Madden

10/30/86

1) I was unable to find any standard notebooks, instrument logbooks, or analyst logbooks (workbooks) that gave <u>any</u> reference to the work performed in this work order.

2) Pesticide Analysis (608)

   a) I found 11 HP 3390 chromatograms related to this analysis (runs #201-204, and 206-207 on 5/30/84, and run 1-4 on 6/1/84, and run 5 on 6/2/84)

      1) No integrator conditions are given

      2) Of the runs made on 6/1-2/84, three are unlabled, but two appear to be standard injections. One is labled, and one is not (runs 1 and 2 of 6/1/84)

         a) The logged sample reads "2uL tests Std 0.05 ug/mL" (run #1)

         b) No column information is given

         c) No pesticide ID's are given, but could be the same as those tentively identified by me, in the same manner, as case 84-04-119

         d) Xerox copies of both standard chromatograms are attached

      3) One method blank injection was made: run #201 on 5/30/84

         a) It is labled "7uL MB 1L ->4mL Pest"

         b) A Xerox copy of this chromatogram is attached

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4) One pesticide spike injection ws made: run #202 on 5/30/84

a) it is labeled "2uL Spike Pest 1L -> 5mL"

b) in addition there are three analyst sheets describing decisions and spike calculations

c) The standard areas appear to be from run #1, 6/1/84

d) The spike areas seem to be from run #202 on 5/30/84

1) The spiked amounts are apparently 0.05 ppb by both compounds (tentatively identified as alpha isomer-BHC and lindane - case #84-04-119)

2) recoveries are indicated as 120% and 180% for two compounds

e) a Xerox copy of the standard injection is attached

f) Xerox copies of the analyst sheets are attached

b) Total QC/QA Data on Pesticides

1) Two pesticide standard chromatograms

2) One method blank chromatogram

3) One spike chromatogram

4) Three analyst sheets (work sheets)

3) Herbicide Analysis (2,4-D and 2,4,5-TP)

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a) I found 11 HP 3390 chromatograms related to this analysis (runs 20, 22-27 on 6 June 84, and runs 29-32 on 6/7/84)

1) No integrator conditions are given

2) Two standard injections were made: run #20 on 6/6/84 and run # 29 on 6/7/84

a) Both chromatyograms are labeled as "2uL HERB STD 0.1 ug/mL"

b) No column information is given

c) No herbicide ID's are given, but are presumably the same as those tentatively made, by me as on case 84-04-119

d) A Xerox copy of both standard injections is attached

3) One method blank injection was made: run #22 on 6/6/84

a) It is labled as "2uL MB 1L -> 5mL"

b) a Xerox copy of this chromatogram is attached

4) One spike injection was made: run #23 on 6/6/84

a) It is labled as "2uL HERB SPIKE 10ug/mL 1L -> 5mL"

b) a Xerox copy of this chromatogram is attached

5) One analyst worksheet is included that describes analyst decisions

a) A Xerox copy of this sheet is attached

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b) Total QA/QC Data on Herbicides

1) 2 Herbicide Standard Chromatograms

2) 1 Herbicid Method Blank Chromatogram

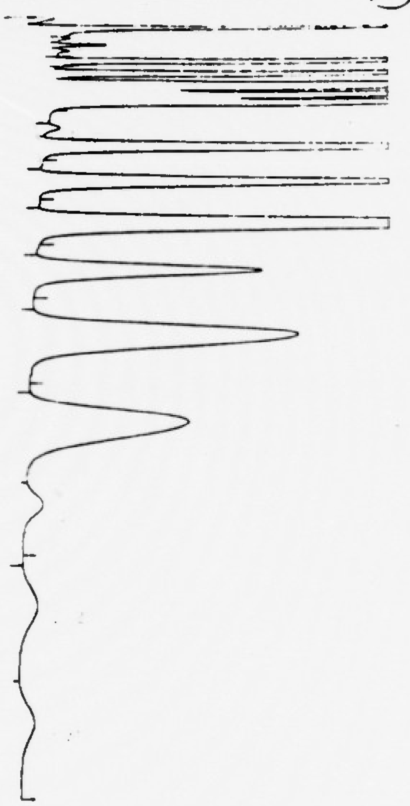
3) 1 Herbicide Spike Chromatogram

4) 1 Analyst Worksheet

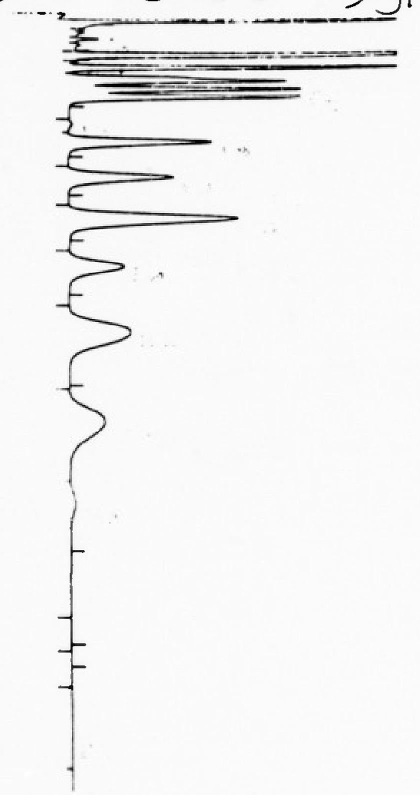
4) Naled (Dibrom) Analysis

There is no data of any kind related to this analysis present in the folder

2ul OC PEST STD .05ug/ml



2ul PEST STD .05ug/ml

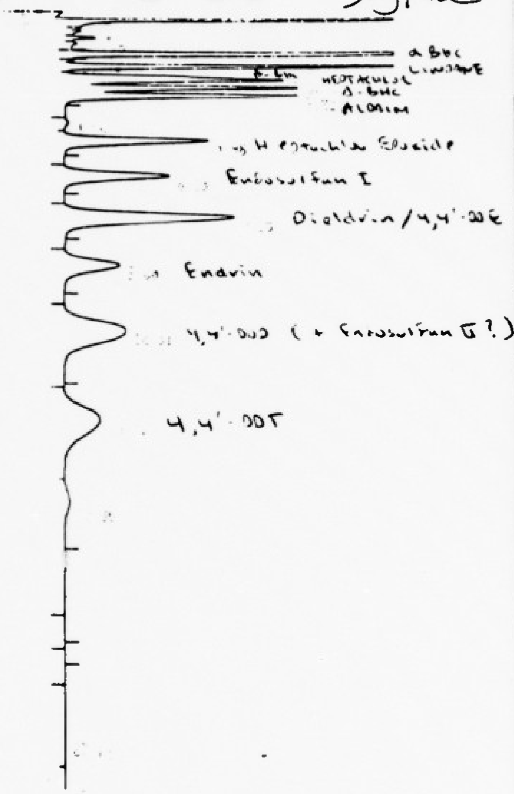


AREA%

RT	AREA	TYPE	AR/HT	
0.15	[illegible]	BB	[illegible]	[illegible]
0.46	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2.[illegible]	884400	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	BB	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

TOTAL AREA= 1.[illegible]E+07
MUL FACTOR= 1.0000E+00

2ul PEST STD .05ug/ml



Annotated 10/30/86
by Steve Madden

(These are tentative
IDs)

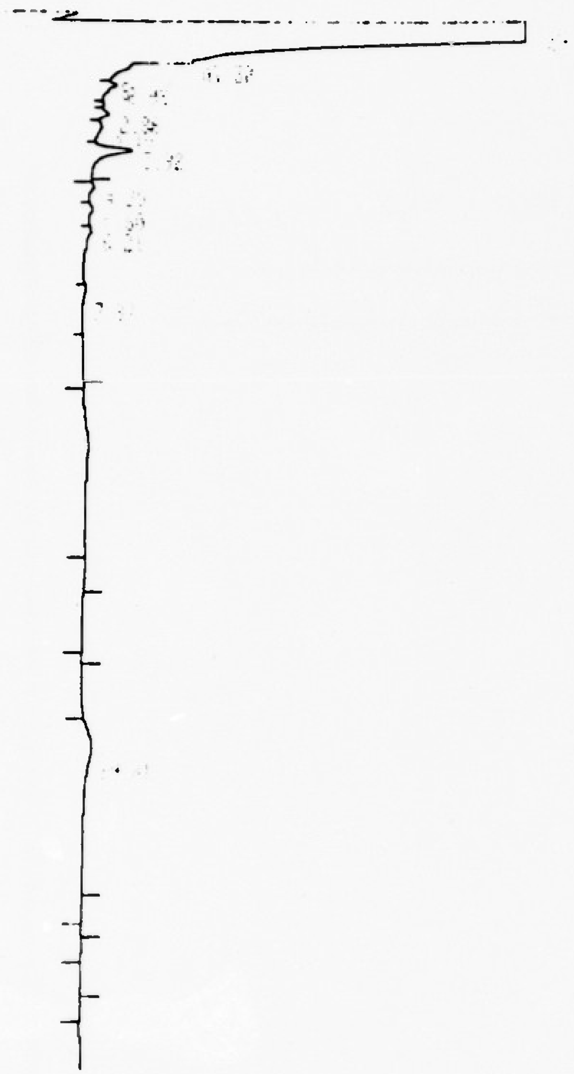
RUN # [illegible]
ID 2-1-[illegible]

AREA%

RT	AREA	TYPE	AR/HT
[illegible]	[illegible]	BB	[illegible]
[illegible]	[illegible]	PP	[illegible]
[illegible]	[illegible]	BB	[illegible]
[illegible]	[illegible]	PV	[illegible]
[illegible]	[illegible]	VV	[illegible]
[illegible]	[illegible]	VP	[illegible]
[illegible]	[illegible]	VB	[illegible]
[illegible]	[illegible]	PB	[illegible]
[illegible]	[illegible]	BB	[illegible]
[illegible]	[illegible]	BB	[illegible]
[illegible]	[illegible]	BB	[illegible]
[illegible]	[illegible]	PB	[illegible]
[illegible]	[illegible]	BB	[illegible]
[illegible]	[illegible]	BP	[illegible]
[illegible]	[illegible]	PB	[illegible]
[illegible]	[illegible]	BP	[illegible]

TOTAL AREA= 1.[illegible]
MUL FACTOR= 1.0000E+00

2ul METHOD BLANK 500ml⇒5ml



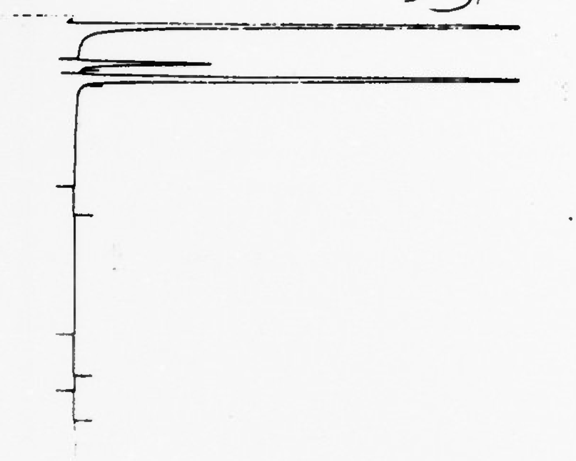
RUN # [illegible] AUG/07/84 18:13:35
ID 2-1-0502-32

AREA%

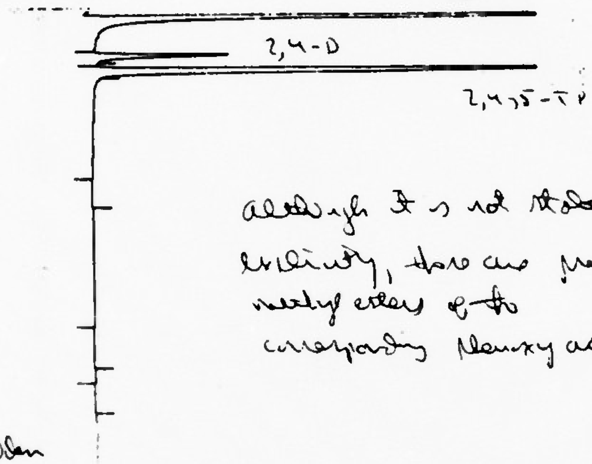
RT	AREA	TYPE	AR/HT	AREA%
[illegible].26	1.75466E+07	SBB	0.132	97.626
0.62	114880	PTBS	0.063	0.641
2.02	11722	BP	0.166	0.065
[illegible].06	12893	VV	0.153	0.071
[illegible].18	10304	VP	0.25[illegible]	0.058
[illegible]	73711	PB	0.751	0.411
[illegible].35	7073	BP	[illegible]	0.039
[illegible].40	28082	PV	[illegible]	0.060
[illegible].71	19281	VP	[illegible]	[illegible]
7.97	10001	PP	[illegible]	0.056
29.41	116340	BB	[illegible]	0.109

TOTAL AREA= 1.79[illegible]E+07
MUL FACTOR= 1.0000E+00

2ml HERB STD 1ug/ml



2µl HERB STD 1µg/ml

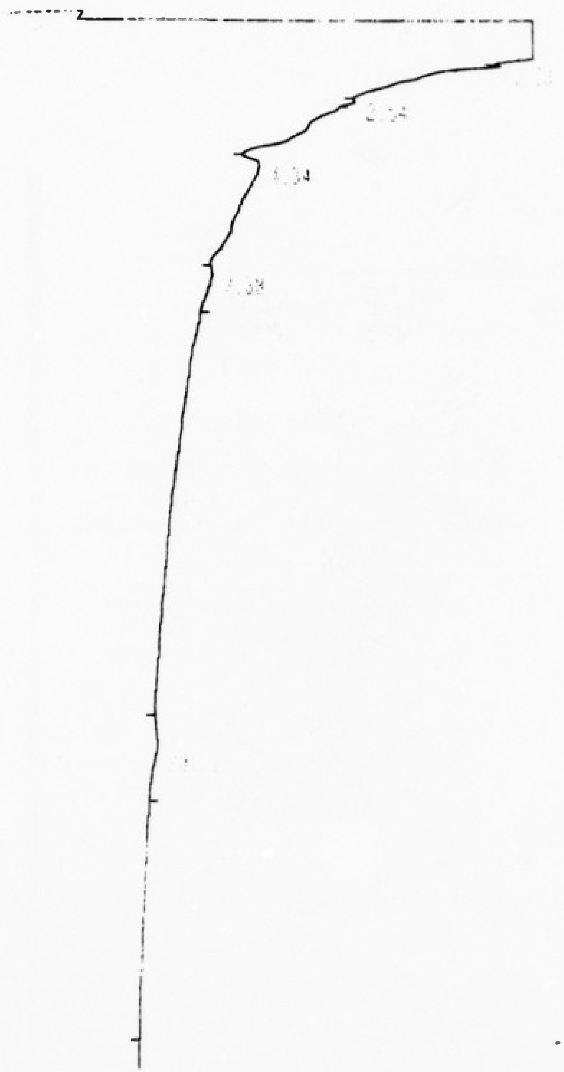


annotated chromatogram

annotated 10/30/86 by Steve Madden

Although it is not stated explicitly, these are presumably methyl esters of the corresponding phenoxy acids

2ul MB-HERB 500ml→5ml



RUN # 24

ID [illegible]

AREA%

RT	AREA	TYPE	AR/HT	AREA%
[illegible]	6.6162E+07	[illegible]	[illegible]	[illegible]
1.53	30829	[illegible]	[illegible]	[illegible]
2.54	15627	[illegible]	.102	[illegible]
4.34	362048	[illegible]	[illegible]	[illegible]
7.38	49152	[illegible]	.106	[illegible]
20.71	[illegible]	[illegible]	[illegible]	[illegible]

TOTAL AREA= [illegible]

MUL FACTOR= [illegible]

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ATTACHMENT 4

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Retention Times - Bergstom AFB 1984/85

Parameter	Retention Times (Column 1)	Retention Times (Column 2)
601/8010		
Chloromethane	2.97	4.44
Bromomethane	3.75	5.77
Vinyl chloride	4.37	4.44
Chloroethane	5.19	7.22
Methylene chloride	7.56	9.09
Trichlorofluoromethane	10.26	5.11
1,1-Dichloroethene	11.43	6.45
1,1-Dichloroethane	12.94	11.24
Trans-1,2-Dichloroethene	14.04	---
Chloroform	14.59	11.24
1,2-Dichloroethane	15.46	16.25
1,1,1-Trichloroethane	16.67	12.11
Carbon tetrachloride	17.07	9.60
Bromodichloromethane	17.78	14.67
1,2-dichloropropane	19.14	---
Trichloroethene	20.14	11.74
Dibromochloromethane	20.64	---
2-Chloroethylvinyl ether	21.99	---
Bromoform	23.41	18.94
Tetrachloroethylene	25.99	13.90
Chlorobenzene	28.44	18.50
1,3-Dichlorobenzene	36.61	22.42
1,2-Dichlorobenzene	37.33	23.68
1,4-Dichlorobenzene	37.59	22.14
602/8020		
Benzene	3.35	6.72
Toluene	4.71	9.85
Ethyl benzene	7.53	13.23
Chlorobenzene	11.06	13.92
1,4-Dichlorobenzene	17.37	26.54
1,3-Dichlorobenzene	18.16	25.14
1,2-Dichlorobenzene	22.71	30.30
P-Xylene	11.61	---
M-Xylene	11.99	---
O-Xylene	12.52	---

RADIAN CORPORATION

Chromatographic Conditions

EPA Method 601 - Column 1 conditions: Carbopack B 60/80 mesh coated with 1% SP-1000 packed in an 8 ft. x 1/8 in. OD glass column with helium carrier gas at a 40 mL/min. flow rate. Column temperature held at 45° for 3 min. then programmed at 8° C/min. to 220° and held for 15 min. Instrument detection = 0.1 ug/L.

EPA Method 601 - Column 2 conditions: Porasil-C 100/120 mesh coated with n-octane packed in a 6 ft x 1/8 in. OD glass column with helium carrier gas at 40 mL/min. flow rate. Column temperature held at 50° C for 3 min. then programmed at 8° C/min. to 170° and held for 4 min.

EPA Method 602 - Column 1 conditions: Supelco 100/120 mesh coated with 5% SP-1200 and 1.75 % Bentone-34 packed in a 6 ft.x 1/8 in. OD glass column with helium carrier gas at 36 mLs/min flow rate. Column temperature held at 50° C for 2 min. then programmed at 6° C/min to 90° C for a final hold. Instrument detection limit = 0.5 ug/L.

EPA Method 602 - Column 2 conditions: Chromosorb W-AW 60/80 mesh coated with 5% 1,2,3-Tris(2-cyanoethyoxy)propane packed in a 6 ft. x 1/8 in. OD glass column with helium carrier gas at 30 mLs/min. flow rate. Column temperature held at 40° C for 2 min. then programmed at 2° C /min. to 100° C for a final hold.

Second column confirmation was performed on workorder # 84 03 205 samples -01, -02, and -04 for method 602. All results reported for benzene and ethylbenzene were confirmed qualitatively. A quantitative confirmation is not performed by second column.

RADIAN CORPORATION

VOA RESULTS

LAB # 8403205-01

CLIENT NAME Bergstrom

SAMPLE ID A036

EPA METHOD 601	Date: Analyst: Instrument:
COMPOUND	**Concentration (µg/L)**
Chloromethane	
Bromomethane	
Vinyl chloride	
Chloroethane	
Methylene chloride	
Trichlorofluoromethane	
1,1-Dichloroethene	
1,1-Dichloroethane	
trans-1,2-Dichloroethene	
Chloroform	
1,2-Dichloroethane	
1,1,1-Trichloroethane	
Carbon tetrachloride	
Bromodichloromethane	
1,2-Dichloropropane	
trans-1,3-Dichloropropene	
Trichloroethene	
Dibromochloromethane 1,1,2-Trichloroethane cis-1,3-Dichloropropene	
2-Chloroethylvinyl ether	
Bromoform	
1,1,2,2-Tetrachloroethane Tetrachloroethylene	
Chlorobenzene	
1,3-Dichlorobenzene	
1,2-Dichlorobenzene	
1,4-Dichlorobenzene	

∅ EPA METHOD 602	Date: 4/5/84 Analyst: G Instrument: [illegible]
COMPOUND	**Concentration (µg/L)**
Benzene	1036
Toluene	
Ethyl benzene	303
1,3-Dichlorobenzene	
1,2-Dichlorobenzene	
1,4-Dichlorobenzene	

1:10

Conf...

COMMENTS

Clean 1

∅ Many compounds that we do not analyze for.

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VOA RESULTS

LAB # 8403205-02
CLIENT NAME BERGSTROM
SAMPLE ID A048

EPA METHOD 601	Date: 4/5/84 Analyst: CL Instrument: Bernadette	EPA METHOD 602	Date: 4/5/84 Analyst: O Instrument: Delores
COMPOUND	Concentration (µg/L)	COMPOUND	Concentration (µg/L)
Chloromethane		Benzene	196
Bromomethane		Toluene	
Vinyl chloride		Ethyl benzene	439
Chloroethane		1,3-Dichlorobenzene	
Methylene chloride		1,2-Dichlorobenzene	
Trichlorofluoromethane	2.3	1,4-Dichlorobenzene	
1,1-Dichloroethene			
1,1-Dichloroethane			
trans-1,2-Dichloroethene	42.6		
Chloroform			
1,2-Dichloroethane			
1,1,1-Trichloroethane			
Carbon tetrachloride			
Bromodichloromethane		COMMENTS	
1,2-Dichloropropane		COLUMN 1	
trans-1,3-Dichloropropene		Ø MANY COMPOUNDS THAT WE DO NOT ANALYZE FOR.	
Trichloroethene	0.8		
Dibromochloromethane 1,1,2-Trichloroethane cis-1,3-Dichloropropene			
2-Chloroethylvinyl ether			
Bromoform			
1,1,2,2-Tetrachloroethane Tetrachloroethylene			
Chlorobenzene			
1,3-Dichlorobenzene			
1,2-Dichlorobenzene			
1,4-Dichlorobenzene			

1:10
conf.

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CORPORATION

VOA RESULTS

LAB # Y403 25-03

CLIENT NAME Bergstrom

SAMPLE ID A049

EPA METHOD 601	Date: Analyst: Instrument:	EPA METHOD 602	Date: 4/5/84 Analyst: CP Instrument: Delos
COMPOUND	Concentration (μg/L)	COMPOUND	Concentration (μg/L)
Chloromethane		Benzene	ND
Bromomethane		Toluene	
Vinyl chloride		Ethyl benzene	
Chloroethane		1,3-Dichlorobenzene	
Methylene chloride		1,2-Dichlorobenzene	
Trichlorofluoromethane		1,4-Dichlorobenzene	
1,1-Dichloroethene			
1,1-Dichloroethane			
trans-1,2-Dichloroethene			
Chloroform			
1,2-Dichloroethane			
1,1,1-Trichloroethane			
Carbon tetrachloride			
Bromodichloromethane		COMMENTS	
1,2-Dichloropropane		Column 1	
trans-1,3-Dichloropropene			
Trichloroethene			
Dibromochloromethane 1,1,2-Trichloroethane cis-1,3-Dichloropropene			
2-Chloroethylvinyl ether			
Bromoform			
1,1,2,2-Tetrachloroethane Tetrachloroethylene			
Chlorobenzene			
1,3-Dichlorobenzene			
1,2-Dichlorobenzene			
1,4-Dichlorobenzene			

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VOA RESULTS

LAB # 8403205-04
CLIENT NAME Bergstrom
SAMPLE ID A051

EPA METHOD 601 — Date: 4/5/84 Analyst: Cl Instrument: Bernadette

COMPOUND	Concentration (µg/L)
Chloromethane	
Bromomethane	
Vinyl chloride	
Chloroethane	
Methylene chloride	
Trichlorofluoromethane	2.4
1,1-Dichloroethene	
1,1-Dichloroethane	
trans-1,2-Dichloroethene	15.8
Chloroform	
1,2-Dichloroethane	
1,1,1-Trichloroethane	
Carbon tetrachloride	
Bromodichloromethane	
1,2-Dichloropropane	
trans-1,3-Dichloropropene	
Trichloroethene	
Dibromochloromethane 1,1,2-Trichloroethane cis-1,3-Dichloropropene	
2-Chloroethylvinyl ether	
Bromoform	
1,1,2,2-Tetrachloroethane Tetrachloroethylene	
Chlorobenzene	
1,3-Dichlorobenzene	
1,2-Dichlorobenzene	
1,4-Dichlorobenzene	

EPA METHOD 602 — Date: 4/5/84 Analyst: Cl Instrument: Delores

COMPOUND	Concentration (µg/L)
Benzene	8.3
Toluene	8
Ethyl benzene	
1,3-Dichlorobenzene	
1,2-Dichlorobenzene	
1,4-Dichlorobenzene	

Confirm by 2nd col

COMMENTS

Column 1

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CORPORATION

VOA RESULTS

LAB # 8502155-01
CLIENT NAME Bastrop
SAMPLE ID A081

EPA METHOD 601	Date: Analyst: Instrument:
COMPOUND	**Concentration (µg/L)**
Chloromethane	
Bromomethane	
Vinyl chloride	
Chloroethane	
Methylene chloride	
Trichlorofluoromethane	
1,1-Dichloroethene	
1,1-Dichloroethane	
trans-1,2-Dichloroethene	
Chloroform	
1,2-Dichloroethane	
1,1,1-Trichloroethane	
Carbon tetrachloride	
Bromodichloromethane	
1,2-Dichloropropane	
Trichloroethene	
Dibromochloromethane 1,1,2-Trichloroethane cis-1,3-Dichloropropene	
2-Chloroethylvinyl ether	
Bromoform	
1,1,2,2-Tetrachloroethane Tetrachloroethylene	
Chlorobenzene	
1,3-Dichlorobenzene	
1,2-Dichlorobenzene	
1,4-Dichlorobenzene	

EPA METHOD 602	Date: 3/6/85 Analyst: C Instrument: Dolan
COMPOUND	**Concentration** mg/kg ~~(µg/L)~~
Benzene	ND
Toluene	
Ethyl benzene	
1,4-Dichlorobenzene	
1,3-Dichlorobenzene	
1,2-Dichlorobenzene	

1:50

COMMENTS

SURROGATE RECOVERIES:

601

Bromochloromethane ______

2-Bromo-1-Chloropropane ______

602

α,α,α,-Trifluorotoluene 102%

2.16 g → 5 ml TG

RADIAN CORPORATION

VOA RESULTS

LAB # 8502155-02

CLIENT NAME Berstron

SAMPLE ID A322

EPA METHOD 601	Date: Analyst: Instrument:
COMPOUND	Concentration ($\mu g/L$)
Chloromethane	
Bromomethane	
Vinyl chloride	
Chloroethane	
Methylene chloride	
Trichlorofluoromethane	
1,1-Dichloroethene	
1,1-Dichloroethane	
trans-1,2-Dichloroethene	
Chloroform	
1,2-Dichloroethane	
1,1,1-Trichloroethane	
Carbon tetrachloride	
Bromodichloromethane	
1,2-Dichloropropane	
Trichloroethene	
Dibromochloromethane 1,1,2-Trichloroethane cis-1,3-Dichloropropene	
2-Chloroethylvinyl ether	
Bromoform	
1,1,2,2-Tetrachloroethane Tetrachloroethylene	
Chlorobenzene	
1,3-Dichlorobenzene	
1,2-Dichlorobenzene	
1,4-Dichlorobenzene	

EPA METHOD 602	Date: 3/6/85 Analyst: CJ Instrument: Olmi
COMPOUND	Concentration mg/kg ~~($\mu g/L$)~~
Benzene	ND
Toluene	
Ethyl benzene	
1,4-Dichlorobenzene	
1,3-Dichlorobenzene	
1,2-Dichlorobenzene	

1:50 ✓

COMMENTS

SURROGATE RECOVERIES:

601

Bromochloromethane ________

2-Bromo-1-Chloropropane ________

602

α,α,α,-Trifluorotoluene 102%

2.08g → 5ml TG

RADIAN CORPORATION

VOA RESULTS

LAB # 8503155-03

CLIENT NAME BERGSTROM

SAMPLE ID A373

EPA METHOD 601	Date: Analyst: Instrument:	EPA METHOD 602	Date: 3/6/85 Analyst: CD Instrument:
COMPOUND	Concentration (µg/L)	COMPOUND	Concentration ~~(µg/L)~~ mg/kg
Chloromethane		Benzene	ND
Bromomethane		Toluene	
Vinyl chloride		Ethyl benzene	
Chloroethane		1,4-Dichlorobenzene	
Methylene chloride		1,3-Dichlorobenzene	
Trichlorofluoromethane		1,2-Dichlorobenzene	
1,1-Dichloroethene			
1,1-Dichloroethane			
trans-1,2-Dichloroethene			
Chloroform			
1,2-Dichloroethane			
1,1,1-Trichloroethane			
Carbon tetrachloride			
Bromodichloromethane			
1,2-Dichloropropane			
Trichloroethene			
Dibromochloromethane 1,1,2-Trichloroethane cis-1,3-Dichloropropene			
2-Chloroethylvinyl ether			
Bromoform			
1,1,2,2-Tetrachloroethane Tetrachloroethylene			
Chlorobenzene			
1,3-Dichlorobenzene			
1,2-Dichlorobenzene			
1,4-Dichlorobenzene			

1:50

COMMENTS

SURROGATE RECOVERIES:

601

Bromochloromethane ______

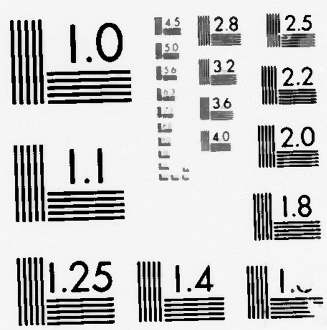
2-Bromo-1-Chloropropane ______

602

α,α,α,-Trifluorotoluene 185%*

2.11g → 5ml TG

* INTERFERENCE



MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

RADIAN
CORPORATION

VOA RESULTS

LAB # 8502155-04

CLIENT NAME BERGSTROM

SAMPLE ID M084

EPA METHOD 601	Date: Analyst: Instrument:
COMPOUND	**Concentration ($\mu g/L$)**
Chloromethane	
Bromomethane	
Vinyl chloride	
Chloroethane	
Methylene chloride	
Trichlorofluoromethane	
1,1-Dichloroethene	
1,1-Dichloroethane	
trans-1,2-Dichloroethene	
Chloroform	
1,2-Dichloroethane	
1,1,1-Trichloroethane	
Carbon tetrachloride	
Bromodichloromethane	
1,2-Dichloropropane	
Trichloroethene	
Dibromochloromethane 1,1,2-Trichloroethane cis-1,3-Dichloropropene	
2-Chloroethylvinyl ether	
Bromoform	
1,1,2,2-Tetrachloroethane Tetrachloroethylene	
Chlorobenzene	
1,3-Dichlorobenzene	
1,2-Dichlorobenzene	
1,4-Dichlorobenzene	

EPA METHOD 602	Date: 3/6/85 Analyst: C Instrument:
COMPOUND	**Concentration** µg/kg ~~($\mu g/L$)~~
Benzene	ND
Toluene	
Ethyl benzene	
1,4-Dichlorobenzene	
1,3-Dichlorobenzene	
1,2-Dichlorobenzene	

1:50 ✓

COMMENTS

SURROGATE RECOVERIES:

601

Bromochloromethane ________

2-Bromo-1-Chloropropane ________

602

α,α,α,-Trifluorotoluene 105 %

1.96 g → 5 ml TG

RADIAN
CORPORATION

VOA RESULTS

LAB # 8502155-05
CLIENT NAME Bergstrom
SAMPLE ID A995

EPA METHOD 601	Date: Analyst: Instrument:
COMPOUND	Concentration (µg/L)
Chloromethane	
Bromomethane	
Vinyl chloride	
Chloroethane	
Methylene chloride	
Trichlorofluoromethane	
1,1-Dichloroethene	
1,1-Dichloroethane	
trans-1,2-Dichloroethene	
Chloroform	
1,2-Dichloroethane	
1,1,1-Trichloroethane	
Carbon tetrachloride	
Bromodichloromethane	
1,2-Dichloropropane	
Trichloroethene	
Dibromochloromethane 1,1,2-Trichloroethane cis-1,3-Dichloropropene	
2-Chloroethylvinyl ether	
Bromoform	
1,1,2,2-Tetrachloroethane Tetrachloroethylene	
Chlorobenzene	
1,3-Dichlorobenzene	
1,2-Dichlorobenzene	
1,4-Dichlorobenzene	

EPA METHOD 602	Date: 3/6/85 Analyst: C Instrument: Delia
COMPOUND	Concentration µg/kg ~~(µg/L)~~
Benzene	ND
Toluene	
Ethyl benzene	
1,4-Dichlorobenzene	
1,3-Dichlorobenzene	
1,2-Dichlorobenzene	

1:50 ✓

COMMENTS

SURROGATE RECOVERIES:

601

Bromochloromethane ______

2-Bromo-1-Chloropropane ______

602

α,α,α,-Trifluorotoluene 120%

1.995 → 5ml TG

RADIAN CORPORATION

VOA RESULTS

LAB # 8502155-06

CLIENT NAME BERGSTROM

SAMPLE ID A86

EPA METHOD 601	Date: Analyst: Instrument:	EPA METHOD 602	Date: 3/6/85 Analyst: KA Instrument: [illegible]
COMPOUND	Concentration (µg/L)	COMPOUND	Concentration ~~(µg/L)~~ µg/kg
Chloromethane		Benzene	ND
Bromomethane		Toluene	
Vinyl chloride		Ethyl benzene	
Chloroethane		1,4-Dichlorobenzene	
Methylene chloride		1,3-Dichlorobenzene	
Trichlorofluoromethane		1,2-Dichlorobenzene	
1,1-Dichloroethene			
1,1-Dichloroethane			
trans-1,2-Dichloroethene			
Chloroform			
1,2-Dichloroethane			
1,1,1-Trichloroethane			
Carbon tetrachloride			
Bromodichloromethane		COMMENTS	
1,2-Dichloropropane		SURROGATE RECOVERIES:	
Trichloroethene		601	
Dibromochloromethane 1,1,2-Trichloroethane cis-1,3-Dichloropropene		Bromochloromethane	
		2-Bromo-1-Chloropropane	
2-Chloroethylvinyl ether		602	
Bromoform		α,α,α,-Trifluorotoluene	124%
1,1,2,2-Tetrachloroethane Tetrachloroethylene		2.00g → 5ml TG	
Chlorobenzene			
1,3-Dichlorobenzene			
1,2-Dichlorobenzene			
1,4-Dichlorobenzene			

1:50 ✓

RADIAN CORPORATION

VOA RESULTS

LAB # 8502155-07

CLIENT NAME Bergstrom

SAMPLE ID 087

EPA METHOD 601	Date: Analyst: Instrument:
COMPOUND	**Concentration (µg/L)**
Chloromethane	
Bromomethane	
Vinyl chloride	
Chloroethane	
Methylene chloride	
Trichlorofluoromethane	
1,1-Dichloroethene	
1,1-Dichloroethane	
trans-1,2-Dichloroethene	
Chloroform	
1,2-Dichloroethane	
1,1,1-Trichloroethane	
Carbon tetrachloride	
Bromodichloromethane	
1,2-Dichloropropane	
Trichloroethene	
Dibromochloromethane 1,1,2-Trichloroethane cis-1,3-Dichloropropene	
2-Chloroethylvinyl ether	
Bromoform	
1,1,2,2-Tetrachloroethane Tetrachloroethylene	
Chlorobenzene	
1,3-Dichlorobenzene	
1,2-Dichlorobenzene	
1,4-Dichlorobenzene	

1:50

EPA METHOD 602	Date: 3/6/85 Analyst: [illegible] Instrument: [illegible]
COMPOUND	**Concentration** mg/kg ~~(µg/L)~~
Benzene	ND / ND
Toluene	
Ethyl benzene	
1,4-Dichlorobenzene	
1,3-Dichlorobenzene	
1,2-Dichlorobenzene	

COMMENTS

SURROGATE RECOVERIES:

601

Bromochloromethane ______

2-Bromo-1-Chloropropane ______

602

α,α,α,-Trifluorotoluene 114%

2.01g → 5ml TG

Dup. ext.

2.07g → 5ml TG

RADIAN CORPORATION

VOA RESULTS

LAB # 8502155-08

CLIENT NAME BERGSTROM

SAMPLE ID A-31

EPA METHOD 601	Date: Analyst: Instrument:
COMPOUND	Concentration (μg/L)
Chloromethane	
Bromomethane	
Vinyl chloride	
Chloroethane	
Methylene chloride	
Trichlorofluoromethane	
1,1-Dichloroethene	
1,1-Dichloroethane	
trans-1,2-Dichloroethene	
Chloroform	
1,2-Dichloroethane	
1,1,1-Trichloroethane	
Carbon tetrachloride	
Bromodichloromethane	
1,2-Dichloropropane	
Trichloroethene	
Dibromochloromethane 1,1,2-Trichloroethane cis-1,3-Dichloropropene	
2-Chloroethylvinyl ether	
Bromoform	
1,1,2,2-Tetrachloroethane Tetrachloroethylene	
Chlorobenzene	
1,3-Dichlorobenzene	
1,2-Dichlorobenzene	
1,4-Dichlorobenzene	

EPA METHOD 602	Date: 3/6/85 Analyst: AA Instrument: Alpha
COMPOUND	Concentration ~~(μg/L)~~ ug/kg
Benzene	ND
Toluene	ND
Ethyl benzene	ND
1,4-Dichlorobenzene	ND
1,3-Dichlorobenzene	ND
1,2-Dichlorobenzene	ND

1:50 X

COMMENTS

SURROGATE RECOVERIES:

601

Bromochloromethane ________

2-Bromo-1-Chloropropane ________

602

α,α,α,-Trifluorotoluene 109%

2.075 → 5ml TG

RADIAN CORPORATION

VOA RESULTS

LAB # 85021155-09

CLIENT NAME Bergstrom

SAMPLE ID A-09

EPA METHOD 601	Date: Analyst: Instrument:
COMPOUND	**Concentration ($\mu g/L$)**
Chloromethane	
Bromomethane	
Vinyl chloride	
Chloroethane	
Methylene chloride	
Trichlorofluoromethane	
1,1-Dichloroethene	
1,1-Dichloroethane	
trans-1,2-Dichloroethene	
Chloroform	
1,2-Dichloroethane	
1,1,1-Trichloroethane	
Carbon tetrachloride	
Bromodichloromethane	
1,2-Dichloropropane	
Trichloroethene	
Dibromochloromethane 1,1,2-Trichloroethane cis-1,3-Dichloropropene	
2-Chloroethylvinyl ether	
Bromoform	
1,1,2,2-Tetrachloroethane Tetrachloroethylene	
Chlorobenzene	
1,3-Dichlorobenzene	
1,2-Dichlorobenzene	
1,4-Dichlorobenzene	

EPA METHOD 602	Date: 3/6/85 Analyst: AL Instrument: Dali
COMPOUND	**Concentration** ug/kg ~~($\mu g/L$)~~
Benzene	ND
Toluene	
Ethyl benzene	
1,4-Dichlorobenzene	
1,3-Dichlorobenzene	
1,2-Dichlorobenzene	

1:50

COMMENTS

SURROGATE RECOVERIES:

601

Bromochloromethane ______

2-Bromo-1-Chloropropane ______

602

α,α,α,-Trifluorotoluene 104%

1.99g → 5ml TG

RADIAN

VOA RESULTS

LAB # 8502155-10
CLIENT NAME Bengstrom
SAMPLE ID A090

EPA METHOD 601	Date: Analyst: Instrument:
COMPOUND	Concentration (µg/L)
Chloromethane	
Bromomethane	
Vinyl chloride	
Chloroethane	
Methylene chloride	
Trichlorofluoromethane	
1,1-Dichloroethene	
1,1-Dichloroethane	
trans-1,2-Dichloroethene	
Chloroform	
1,2-Dichloroethane	
1,1,1-Trichloroethane	
Carbon tetrachloride	
Bromodichloromethane	
1,2-Dichloropropane	
Trichloroethene	
Dibromochloromethane 1,1,2-Trichloroethane cis-1,3-Dichloropropene	
2-Chloroethylvinyl ether	
Bromoform	
1,1,2,2-Tetrachloroethane Tetrachloroethylene	
Chlorobenzene	
1,3-Dichlorobenzene	
1,2-Dichlorobenzene	
1,4-Dichlorobenzene	

EPA METHOD 602	Date: 3/6/85 Analyst: AA Instrument: Delia
COMPOUND	Concentration ~~(µg/L)~~ mg/kg
Benzene	ND
Toluene	ND
Ethyl benzene	ND
1,4-Dichlorobenzene	ND
1,3-Dichlorobenzene	ND
1,2-Dichlorobenzene	ND

1:50

COMMENTS

SURROGATE RECOVERIES:

601

Bromochloromethane ______

2-Bromo-1-Chloropropane ______

602

α,α,α,-Trifluorotoluene 89%

2.08g → 5ml TG

RADIAN

VOA RESULTS

LAB # 8502155-41

CLIENT NAME [illegible]

SAMPLE ID A091

EPA METHOD 601	Date: Analyst: Instrument:
COMPOUND	**Concentration (µg/L)**
Chloromethane	
Bromomethane	
Vinyl chloride	
Chloroethane	
Methylene chloride	
Trichlorofluoromethane	
1,1-Dichloroethene	
1,1-Dichloroethane	
trans-1,2-Dichloroethene	
Chloroform	
1,2-Dichloroethane	
1,1,1-Trichloroethane	
Carbon tetrachloride	
Bromodichloromethane	
1,2-Dichloropropane	
Trichloroethene	
Dibromochloromethane 1,1,2-Trichloroethane cis-1,3-Dichloropropene	
2-Chloroethylvinyl ether	
Bromoform	
1,1,2,2-Tetrachloroethane Tetrachloroethylene	
Chlorobenzene	
1,3-Dichlorobenzene	
1,2-Dichlorobenzene	
1,4-Dichlorobenzene	

EPA METHOD 602	Date: 3/1/85 Analyst: RA Instrument: [illegible]
COMPOUND	**Concentration** mg/kg ~~(µg/L)~~
Benzene	WD
Toluene	
Ethyl benzene	
1,4-Dichlorobenzene	
1,3-Dichlorobenzene	
1,2-Dichlorobenzene	

1:50

COMMENTS

SURROGATE RECOVERIES:

601

Bromochloromethane ________

2-Bromo-1-Chloropropane ________

602

α,α,α,-Trifluorotoluene 107%

2.045 → 5ml TC

RADIAN
CORPORATION

VOA RESULTS

LAB # 8502155-12
CLIENT NAME Bengtson
SAMPLE ID A092

EPA METHOD 601	Date: Analyst: Instrument:
COMPOUND	**Concentration (μg/L)**
Chloromethane	
Bromomethane	
Vinyl chloride	
Chloroethane	
Methylene chloride	
Trichlorofluoromethane	
1,1-Dichloroethene	
1,1-Dichloroethane	
trans-1,2-Dichloroethene	
Chloroform	
1,2-Dichloroethane	
1,1,1-Trichloroethane	
Carbon tetrachloride	
Bromodichloromethane	
1,2-Dichloropropane	
Trichloroethene	
Dibromochloromethane 1,1,2-Trichloroethane cis-1,3-Dichloropropene	
2-Chloroethylvinyl ether	
Bromoform	
1,1,2,2-Tetrachloroethane Tetrachloroethylene	
Chlorobenzene	
1,3-Dichlorobenzene	
1,2-Dichlorobenzene	
1,4-Dichlorobenzene	

EPA METHOD 602	Date: 3/6/85 Analyst: RA Instrument: Olin
COMPOUND	**Concentration** mg/kg ~~(μg/L)~~
Benzene	ND
Toluene	↓
Ethyl benzene	↓
1,4-Dichlorobenzene	↓
1,3-Dichlorobenzene	↓
1,2-Dichlorobenzene	↓

1:50

COMMENTS

SURROGATE RECOVERIES:

601

Bromochloromethane ______

2-Bromo-1-Chloropropane ______

602

α,α,α,-Trifluorotoluene 107%

2.05g → 5ml TG

RADIAN
CORPORATION

VOA RESULTS

LAB # 8502155-43
CLIENT NAME Bergstrom
SAMPLE ID A013

EPA METHOD 601	Date: Analyst: Instrument:
COMPOUND	**Concentration (μg/L)**
Chloromethane	
Bromomethane	
Vinyl chloride	
Chloroethane	
Methylene chloride	
Trichlorofluoromethane	
1,1-Dichloroethene	
1,1-Dichloroethane	
trans-1,2-Dichloroethene	
Chloroform	
1,2-Dichloroethane	
1,1,1-Trichloroethane	
Carbon tetrachloride	
Bromodichloromethane	
1,2-Dichloropropane	
Trichloroethene	
Dibromochloromethane 1,1,2-Trichloroethane cis-1,3-Dichloropropene	
2-Chloroethylvinyl ether	
Bromoform	
1,1,2,2-Tetrachloroethane Tetrachloroethylene	
Chlorobenzene	
1,3-Dichlorobenzene	
1,2-Dichlorobenzene	
1,4-Dichlorobenzene	

EPA METHOD 602	Date: 3/6/85 Analyst: JA Instrument: Delri
COMPOUND	**Concentration** mg/kg ~~(μg/L)~~
Benzene	ND
Toluene	
Ethyl benzene	
1,4-Dichlorobenzene	
1,3-Dichlorobenzene	
1,2-Dichlorobenzene	

1:50

COMMENTS

SURROGATE RECOVERIES:

601

Bromochloromethane ______

2-Bromo-1-Chloropropane ______

602

α,α,α,-Trifluorotoluene 113%

2.145 → 5ml TC

RADIAN CORPORATION

VOA RESULTS

LAB # 8502155-14

CLIENT NAME Bengston

SAMPLE ID AD94

EPA METHOD 601	Date: Analyst: Instrument:	EPA METHOD 602	Date: 3/6/85 Analyst: RA Instrument: Dehn
COMPOUND	Concentration (μg/L)	COMPOUND	Concentration mg/kg ~~(μg/L)~~
Chloromethane		Benzene	ND
Bromomethane		Toluene	
Vinyl chloride		Ethyl benzene	
Chloroethane		1,4-Dichlorobenzene	
Methylene chloride		1,3-Dichlorobenzene	
Trichlorofluoromethane		1,2-Dichlorobenzene	
1,1-Dichloroethene			
1,1-Dichloroethane			
trans-1,2-Dichloroethene			
Chloroform			
1,2-Dichloroethane			
1,1,1-Trichloroethane			
Carbon tetrachloride			
Bromodichloromethane		COMMENTS	
1,2-Dichloropropane		SURROGATE RECOVERIES:	
Trichloroethene		601	
Dibromochloromethane 1,1,2-Trichloroethane cis-1,3-Dichloropropene		Bromochloromethane	
		2-Bromo-1-Chloropropane	
2-Chloroethylvinyl ether		602	
Bromoform		α,α,α,-Trifluorotoluene	97%
1,1,2,2-Tetrachloroethane Tetrachloroethylene		2.06g → 5ml TC	
Chlorobenzene			
1,3-Dichlorobenzene			
1,2-Dichlorobenzene			
1,4-Dichlorobenzene			

1:50

RADIAN CORPORATION

VOA RESULTS

LAB # 8502155-15

CLIENT NAME BENGSTROM

SAMPLE ID A055

EPA METHOD 601	Date: Analyst: Instrument:
COMPOUND	Concentration (μg/L)
Chloromethane	
Bromomethane	
Vinyl chloride	
Chloroethane	
Methylene chloride	
Trichlorofluoromethane	
1,1-Dichloroethene	
1,1-Dichloroethane	
trans-1,2-Dichloroethene	
Chloroform	
1,2-Dichloroethane	
1,1,1-Trichloroethane	
Carbon tetrachloride	
Bromodichloromethane	
1,2-Dichloropropane	
Trichloroethene	
Dibromochloromethane 1,1,2-Trichloroethane cis-1,3-Dichloropropene	
2-Chloroethylvinyl ether	
Bromoform	
1,1,2,2-Tetrachloroethane Tetrachloroethylene	
Chlorobenzene	
1,3-Dichlorobenzene	
1,2-Dichlorobenzene	
1,4-Dichlorobenzene	

1:50

EPA METHOD 602	Date: 3/7/85 Analyst: G Instrument: [illegible]	
COMPOUND	Concentration mg/kg (μg/L)	Dup
Benzene	ND	ND
Toluene		
Ethyl benzene		
1,4-Dichlorobenzene		
1,3-Dichlorobenzene		
1,2-Dichlorobenzene		

COMMENTS

SURROGATE RECOVERIES:

601

Bromochloromethane ______

2-Bromo-1-Chloropropane ______

602

α,α,α,-Trifluorotoluene 85%

2.11g → 5ml TG

DUP 1

2.11g → 5ml TG

RADIAN CORPORATION

VOA RESULTS

LAB # 8502155-16

CLIENT NAME Bergstrom

SAMPLE ID A056

EPA METHOD 601	Date: Analyst: Instrument:	EPA METHOD 602	Date: 3/7/85 Analyst: C Instrument: Dohrmann
COMPOUND	Concentration (μg/L)	COMPOUND	Concentration ~~(μg/L)~~ mg/kg
Chloromethane		Benzene	ND
Bromomethane		Toluene	
Vinyl chloride		Ethyl benzene	
Chloroethane		1,4-Dichlorobenzene	
Methylene chloride		1,3-Dichlorobenzene	
Trichlorofluoromethane		1,2-Dichlorobenzene	
1,1-Dichloroethene			
1,1-Dichloroethane			
trans-1,2-Dichloroethene			
Chloroform			
1,2-Dichloroethane			
1,1,1-Trichloroethane			
Carbon tetrachloride			
Bromodichloromethane			
1,2-Dichloropropane			
Trichloroethene			
Dibromochloromethane 1,1,2-Trichloroethane cis-1,3-Dichloropropene			
2-Chloroethylvinyl ether			
Bromoform			
1,1,2,2-Tetrachloroethane Tetrachloroethylene			
Chlorobenzene			
1,3-Dichlorobenzene			
1,2-Dichlorobenzene			
1,4-Dichlorobenzene			

1:50

COMMENTS

SURROGATE RECOVERIES:

601

Bromochloromethane ______

2-Bromo-1-Chloropropane ______

602

α,α,α,-Trifluorotoluene 88%

2.15g → 5ml TG

RADIAN
CORPORATION

VOA RESULTS

LAB # 8502155-17
CLIENT NAME Bergstrom
SAMPLE ID A057

EPA METHOD 601	Date: Analyst: Instrument:	EPA METHOD 602	Date: 3/7/85 Analyst: C Instrument:
COMPOUND	Concentration (µg/L)	COMPOUND	Concentration mg/kg ~~(µg/L)~~
Chloromethane		Benzene	ND
Bromomethane		Toluene	
Vinyl chloride		Ethyl benzene	
Chloroethane		1,4-Dichlorobenzene	
Methylene chloride		1,3-Dichlorobenzene	
Trichlorofluoromethane		1,2-Dichlorobenzene	
1,1-Dichloroethene			
1,1-Dichloroethane			
trans-1,2-Dichloroethene			
Chloroform			
1,2-Dichloroethane			
1,1,1-Trichloroethane			
Carbon tetrachloride			
Bromodichloromethane			
1,2-Dichloropropane			
Trichloroethene			
Dibromochloromethane 1,1,2-Trichloroethane cis-1,3-Dichloropropene			
2-Chloroethylvinyl ether			
Bromoform			
1,1,2,2-Tetrachloroethane Tetrachloroethylene			
Chlorobenzene			
1,3-Dichlorobenzene			
1,2-Dichlorobenzene			
1,4-Dichlorobenzene			

1:50

COMMENTS

SURROGATE RECOVERIES:

601

Bromochloromethane ______

2-Bromo-1-Chloropropane ______

602

α,α,α,-Trifluorotoluene 92%

2.13g → 5ml TG

RADIAN CORPORATION

VOA RESULTS

LAB # 3502155-18

CLIENT NAME Bergstrom

SAMPLE ID A098

1:50 ✓

EPA METHOD 601	Date: Analyst: Instrument:
COMPOUND	**Concentration (µg/L)**
Chloromethane	
Bromomethane	
Vinyl chloride	
Chloroethane	
Methylene chloride	
Trichlorofluoromethane	
1,1-Dichloroethene	
1,1-Dichloroethane	
trans-1,2-Dichloroethene	
Chloroform	
1,2-Dichloroethane	
1,1,1-Trichloroethane	
Carbon tetrachloride	
Bromodichloromethane	
1,2-Dichloropropane	
Trichloroethene	
Dibromochloromethane 1,1,2-Trichloroethane cis-1,3-Dichloropropene	
2-Chloroethylvinyl ether	
Bromoform	
1,1,2,2-Tetrachloroethane Tetrachloroethylene	
Chlorobenzene	
1,3-Dichlorobenzene	
1,2-Dichlorobenzene	
1,4-Dichlorobenzene	

EPA METHOD 602	Date: 3/7/85 Analyst: ci Instrument: [illegible]
COMPOUND	**Concentration** mg/kg ~~(µg/L)~~
Benzene	ND
Toluene	
Ethyl benzene	
1,4-Dichlorobenzene	
1,3-Dichlorobenzene	
1,2-Dichlorobenzene	

COMMENTS

SURROGATE RECOVERIES:

601

Bromochloromethane ________

2-Bromo-1-Chloropropane ________

602

α,α,α,-Trifluorotoluene 96%

5.1g → 5ml TG

RADIAN
CORPORATION

VOA RESULTS

LAB # 8503155-19
CLIENT NAME Bengston
SAMPLE ID A099

EPA METHOD 601	Date: Analyst: Instrument:	EPA METHOD 602	Date: 3/7/85 Analyst: C Instrument: VDi
COMPOUND	Concentration (μg/L)	COMPOUND	Concentration ~~(μg/L)~~ ug/kg
Chloromethane		Benzene	ND
Bromomethane		Toluene	
Vinyl chloride		Ethyl benzene	
Chloroethane		1,4-Dichlorobenzene	
Methylene chloride		1,3-Dichlorobenzene	
Trichlorofluoromethane		1,2-Dichlorobenzene	N
1,1-Dichloroethene			
1,1-Dichloroethane			
trans-1,2-Dichloroethene			
Chloroform			
1,2-Dichloroethane			
1,1,1-Trichloroethane			
Carbon tetrachloride			
Bromodichloromethane			
1,2-Dichloropropane			
Trichloroethene			
Dibromochloromethane 1,1,2-Trichloroethane cis-1,3-Dichloropropene			
2-Chloroethylvinyl ether			
Bromoform			
1,1,2,2-Tetrachloroethane Tetrachloroethylene			
Chlorobenzene			
1,3-Dichlorobenzene			
1,2-Dichlorobenzene			
1,4-Dichlorobenzene			

1:50

COMMENTS

SURROGATE RECOVERIES:

601

Bromochloromethane ______

2-Bromo-1-Chloropropane ______

602

α,α,α,-Trifluorotoluene 95%

2.07g → 5ml TG

RADIAN CORPORATION

VOA RESULTS

LAB # 8502155-20

CLIENT NAME Beale/10r

SAMPLE ID K/100

EPA METHOD 601	Date: Analyst: Instrument:
COMPOUND	**Concentration (µg/L)**
Chloromethane	
Bromomethane	
Vinyl chloride	
Chloroethane	
Methylene chloride	
Trichlorofluoromethane	
1,1-Dichloroethene	
1,1-Dichloroethane	
trans-1,2-Dichloroethene	
Chloroform	
1,2-Dichloroethane	
1,1,1-Trichloroethane	
Carbon tetrachloride	
Bromodichloromethane	
1,2-Dichloropropane	
Trichloroethene	
Dibromochloromethane 1,1,2-Trichloroethane cis-1,3-Dichloropropene	
2-Chloroethylvinyl ether	
Bromoform	
1,1,2,2-Tetrachloroethane Tetrachloroethylene	
Chlorobenzene	
1,3-Dichlorobenzene	
1,2-Dichlorobenzene	
1,4-Dichlorobenzene	

1:50

EPA METHOD 602	Date: 3/7/85 Analyst: [illegible] Instrument: [illegible]
COMPOUND	**Concentration ~~(µg/L)~~** µg/l
Benzene	ND
Toluene	
Ethyl benzene	
1,4-Dichlorobenzene	
1,3-Dichlorobenzene	
1,2-Dichlorobenzene	

COMMENTS

SURROGATE RECOVERIES:

601

Bromochloromethane ________

2-Bromo-1-Chloropropane ________

602

α,α,α,-Trifluorotoluene 103%

2.205 → 5ml TF

RADIAN
CORPORATION

VOA RESULTS

LAB # 8502155-21

CLIENT NAME Bergstrom

SAMPLE ID AD 90 QC

EPA METHOD 601	Date: Analyst: Instrument:
COMPOUND	**Concentration (µg/L)**
Chloromethane	
Bromomethane	
Vinyl chloride	
Chloroethane	
Methylene chloride	
Trichlorofluoromethane	
1,1-Dichloroethene	
1,1-Dichloroethane	
trans-1,2-Dichloroethene	
Chloroform	
1,2-Dichloroethane	
1,1,1-Trichloroethane	
Carbon tetrachloride	
Bromodichloromethane	
1,2-Dichloropropane	
Trichloroethene	
Dibromochloromethane 1,1,2-Trichloroethane cis-1,3-Dichloropropene	
2-Chloroethylvinyl ether	
Bromoform	
1,1,2,2-Tetrachloroethane Tetrachloroethylene	
Chlorobenzene	
1,3-Dichlorobenzene	
1,2-Dichlorobenzene	
1,4-Dichlorobenzene	

EPA METHOD 602	Date: 3/7/85 Analyst: NA Instrument: Rd
COMPOUND	**Concentration** mg/kg ~~(µg/L)~~
Benzene	ND
Toluene	
Ethyl benzene	
1,4-Dichlorobenzene	
1,3-Dichlorobenzene	
1,2-Dichlorobenzene	

1:50

COMMENTS

SURROGATE RECOVERIES:

601

Bromochloromethane ________

2-Bromo-1-Chloropropane ________

602

α,α,α,-Trifluorotoluene 107%

2.07g → 5ml TG

RADIAN
CORPORATION

VOA RESULTS

LAB # 8502173-01
CLIENT NAME BERGSTROM
SAMPLE ID A103

EPA METHOD 601	Date: Analyst: Instrument:
COMPOUND	**Concentration (µg/L)**
Chloromethane	
Bromomethane	
Vinyl chloride	
Chloroethane	
Methylene chloride	
Trichlorofluoromethane	
1,1-Dichloroethene	
1,1-Dichloroethane	
trans-1,2-Dichloroethene	
Chloroform	
1,2-Dichloroethane	
1,1,1-Trichloroethane	
Carbon tetrachloride	
Bromodichloromethane	
1,2-Dichloropropane	
Trichloroethene	
Dibromochloromethane 1,1,2-Trichloroethane cis-1,3-Dichloropropene	
2-Chloroethylvinyl ether	
Bromoform	
1,1,2,2-Tetrachloroethane Tetrachloroethylene	
Chlorobenzene	
1,3-Dichlorobenzene	
1,2-Dichlorobenzene	
1,4-Dichlorobenzene	

EPA METHOD 602	Date: 3/1/85 Analyst: MA Instrument: Delos
COMPOUND	**Concentration (µg/L)**
Benzene	ND
Toluene	
Ethyl benzene	
1,4-Dichlorobenzene	
1,3-Dichlorobenzene	
1,2-Dichlorobenzene	

COMMENTS

SURROGATE RECOVERIES:

601

Bromochloromethane ______

2-Bromo-1-Chloropropane ______

602

α,α,α,-Trifluorotoluene 89%

RADIAN
CORPORATION

VOA RESULTS

LAB # 8500172-02

CLIENT NAME Bergstrom

SAMPLE ID A104

EPA METHOD 601	Date: Analyst: Instrument:
COMPOUND	**Concentration (μg/L)**
Chloromethane	
Bromomethane	
Vinyl chloride	
Chloroethane	
Methylene chloride	
Trichlorofluoromethane	
1,1-Dichloroethene	
1,1-Dichloroethane	
trans-1,2-Dichloroethene	
Chloroform	
1,2-Dichloroethane	
1,1,1-Trichloroethane	
Carbon tetrachloride	
Bromodichloromethane	
1,2-Dichloropropane	
Trichloroethene	
Dibromochloromethane 1,1,2-Trichloroethane cis-1,3-Dichloropropene	
2-Chloroethylvinyl ether	
Bromoform	
1,1,2,2-Tetrachloroethane Tetrachloroethylene	
Chlorobenzene	
1,3-Dichlorobenzene	
1,2-Dichlorobenzene	
1,4-Dichlorobenzene	

EPA METHOD 602	Date: 3/1/85 Analyst: [illegible] Instrument: [illegible]
COMPOUND	**Concentration (μg/L)**
Benzene	ND
Toluene	
Ethyl benzene	
1,4-Dichlorobenzene	
1,3-Dichlorobenzene	
1,2-Dichlorobenzene	

COMMENTS

SURROGATE RECOVERIES:

601

Bromochloromethane ______

2-Bromo-1-Chloropropane ______

602

α,α,α,-Trifluorotoluene 87%

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ATTACHMENT 5

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PESTICIDE ANALYSIS

Parameter	Primary Column Retention Times (minutes)	Method Detection Limits (MDL) (ug/L) 500 ml -> 5 ml 8404119	1 L -> 5 ml 8405059
α-BHC	1.59	0.10	0.05
Lindane	2.08	0.10	0.05
B-BHC	2.62	0.10	0.05
Heptachlor	2.62	0.10	0.05
D-BHC	2.92	0.10	0.05
Aldrin	3.22	0.10	0.05
Hept. Epoxide	4.98	0.10	0.05
α-Endosulfan	6.33	0.10	0.05
B-Endosulfan	NA	NA	NA
Dieldrin	7.95	0.20	0.10
DDE	7.95	0.20	0.10
Endrin	9.80	0.20	0.10
DDD	12.31	0.20	0.10
DDT	15.21	0.20	0.10
Endrin aldehyde	NA	0.20	0.10
Endosulfan sulfate	NA	0.20	0.10
Chlordane	NA	0.10	0.05
Toxaphene	NA	2.0	1.0
Ar 1016	NA	1.0	0.05
AR 1260	NA	2.0	1.0
AR 1221	NA	1.0	0.05
AR 1254	NA	2.0	1.0
AR 1232	NA	1.0	0.05
AR 1242	NA	1.0	0.05
AR 1248	NA	1.0	0.05

Methods

EPA Method 608 Pest/PCBs in water
EPA Method 615 Herb's in water

Holding Times

	Extraction	Analysis
608	7 days of collection	40 days of extraction
615	7 days of collection	40 days of extraction

NOTE: MDLs are estimated from CLP CRDLs and assume no dilutions were performed.

APPENDIX I

CORRESPONDENCE WITH FEDERAL, STATE, AND/OR LOCAL REGULATORY AUTHORITIES

Radian did not have a need or requirement to correspond with regulatory authorities during the conduct of this IRP.

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APPENDIX J

REFERENCES

APPENDIX J

References

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Rose, Peter R. Edwards Group, Surface and Subsurface, Central Texas. Bureau of Economic Geology, University of Texas at Austin, Austin, Texas, Report of Investigations No. 74, 1972.

Woodruff, Jr., C. M. Land Resource Overview of the Capital Area Planning Council Region, Texas. Bureau of Economic Geology, The University of Texas at Austin, Austin, Texas, 1979.

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APPENDIX K

BIOGRAPHIES OF KEY PERSONNEL

Thomas W. Grimshaw - Project Manager
Rick A. Belan - Project Director & Co-Author
E. Wayne Pearce - Principle Author
William M. Little - Technical Review
Peter A. Waterreus - Sampling & Co-Author
Jenny B. Chapman - Co-Author
Jill P. Rossi - Cartographer

RADIAN
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THOMAS W. GRIMSHAW

EDUCATION:

Ph.D., Geology, University of Texas at Austin, 1976.

M.S., Geology, University of Texas at Austin, 1970.

B.S., Geological Engineering, South Dakota School of Mines and Technology, 1967.

EXPERIENCE:

Program Manager, Radian Corporation, Austin, TX, 1984-Present.

Division Manager, Policy and Environmental Analysis Division, Radian Corporation, 1982-1984.

Department Head, Environmental Analysis Department, Radian Corporation, 1978-1982.

Group Leader, Radian Corporation, 1976-1978.

Teaching Assistant, The University of Texas at Austin, 1974.

Captain (R&D Coordinator), U.S. Army, 1970-1972.

Geologist, Junior Grade, Amoco Production Company, 1969-1970.

Geologic Field Assistant, Amoco Production Company, 1967.

Certification: AIPG Certified Professional Geologist No. 4425

FIELDS OF EXPERIENCE:

As Program Manager at Radian, Dr. Grimshaw has overall responsibility for the technical, fiscal, and schedule aspects of several solid/hazardous waste, ground-water, and other environmental projects. For these projects, he serves as the primary point of contact for the clients sponsoring the work. Dr. Grimshaw is also responsible for marketing and preparing proposals for Radian services in a variety of areas, including solid/hazardous waste site investigations, remedial action planning and implementation, ground-water contamination studies, multidisciplinary environmental studies, and reclamation investigations.

Most recently, Dr. Grimshaw has served as Program Manager (PM) for solid/hazardous waste disposal investigations at seven U.S. Air Force bases in Texas,

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Thomas W. Grimshaw

Oklahoma, Louisiana, and New Mexico. These projects, which are being performed for the USAF Occupational and Environmental Health Laboratory, Brooks AFB, Texas, are an integral part of the Air Force Installation Restoration Program. Each investigation includes soil sampling and analysis, monitor well installation, and surface water sampling and analysis. The resulting data are interpreted in terms of degree of soils, ground-water, and surface-water impacts, and recommendations are made for investigations for defining remedial measures to be undertaken.

Also for the Air Force, Dr. Grimshaw is PM for wastewater investigations at Kelly AFB and Laughlin AFB, Texas. The study at Kelly AFB is to detemine the source and characteristics of industrial wastewater and other inflows to the storm sewer system and to make recommendations for redirecting these flows to the industrial wastewater treatment plant. The investigation at Laughlin AFB is a comprehensive evaluation of the effectiveness of the existing wastewater treatment system accompanied by recommendations for required changes to the system.

Dr. Grimshaw is also PM for an ongoing task order contract for a large IBM manufacturing plant in Austin, Texas. This contract is for sampling, analysis, and related services for ground-water monitor wells, wastewater streams, and other sources in the plant.

For a major law firm in Kansas City, Missouri, Dr. Grimshaw is serving as PM for a program to provide Expert Witness and corollary services related to a hazardous waste disposal site in Kansas City. A lawsuit has been filed against the four largest Potentially Responsible Party generators and the owner/operator by the U.S. Department of Justice (who received the case by referral from the U.S. Environmental Protection Agency). Radian is working with the law firm representing the former owner/operator of the site.

Expert support is being provided in the following areas: 1) oversight of Remedial Investigation and Feasibility Study activities by the U.S. EPA and the PRP generators; 2) review of depositions and recommendations for line of questioning by the attorneys; 3) support of automation of disposal records with the objective of developing a basis for allocation of investigation and cleanup costs ; 4) prepare and give technical presentations on the case to the attorneys involved; and 5) prepare and execute work plans to on-site technical studies to be undertaken at the site.

The Western Company of North America, Fort Worth, Texas is an oil field servicing firm whose operations generate hazardous wastes. Dr. Grimshaw is PM for a program being performed for the Western Company to achieve compliance with Texas Department of Water Resources regulations at three of their sites in Kermit, Odessa, and Rankin. Activities for this program to date have included preparation of a Plan of Action for obtaining compliance and a Waste Analysis plan, both of which have been submitted to TDWR for approval.

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Thomas W. Grimshaw

Dr. Grimshaw is PM for a site investigation and remediation for a pesticide-contaminated site in Arizona owned by University Financial Investors Corporation. This project has included soil sampling and analysis for pesticides, remedial plan preparation, and presentations to state and EPA regulatory authorities.

Dr. Grimshaw has served as Technical Coordinator for over 40 risk assessment surveys for Environmental Impairment Liability (EIL) insurance policies. The purpose of these surveys is to provide EIL insurance underwriters the data needed for assessing the risks involved in providing insurance coverage for the facilities surveyed. Dr. Grimshaw also personally performed six EIL surveys involving facilities at more than 30 locations around the country. These facilities included a hazardous waste landfill, numerous industrial and municipal wastewater treatment plants, a municipal landfill, an aluminum forging plant and a casting plant, a magnet wire production facility, and several paper mills.

Dr. Grimshaw was Project Director for an investigation of an unpermitted disposal site located near Dallas, Texas. This project, which was performed for a major law firm in Dallas, included extensive waste and soil sampling and analysis, delineation of specific sites of disposal, and recommendations for disposition of the waste materials found. Several meetings were held with the regulatory agency, the Texas Department of Water Resources.

In another investigation for the same law firm, Dr. Grimshaw was Project Director for a soil sampling and analysis and ground-water monitoring project at a PCB disposal site. The area of contamination was defined by surface and shallow subsurface soil sampling on a modified grid pattern, and two monitor wells were installed. A recommendation involving soil removal, redepositing, and pavement was made to address the PCB contamination at the site.

For a large program conducted for International Paper Company, Dr. Grimshaw served as Technical Coordinator for developing Closure Plans for impoundments at wood treatment plants in three states. This program included a full complement of studies to define the existing situation and prepare a plan of remedial action for each plant. The initial activity was the sampling and analysis of pond supernatant and sludge, subsoil, and ground water. Bench-scale stabilization studies were performed on the sludge using a number of candidate commercial stabilizing compounds. Several closure alternatives were developed and screened, and a set of alternatives was selected for inclusion in conceptual plans. After the conceptual plans were approved by the client and the regulatory agencies, a detailed design was prepared and specifications developed.

For Tuloma Energies, Inc., Radian performed a program directed by Dr. Grimshaw for development of a commercial Hazardous Waste Management Facility in north-

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eastern Oklahoma. During the initial phases of this project, a market analysis was performed to determine the sources at waste that could potentially use the new facility. Subsequently, a regional screening analysis was performed to identify areas most likely to have suitable sites for the new facility. This analysis included screening for several factors, including hydrologic, geologic, topographic, ecologic, and aerometric characteristics as well as population density. Dr. Grimshaw assisted Tuloma Energies in coordinating with the state regulatory agency (Oklahoma Department of Health) during the initial phases of the project.

Dr. Grimshaw was Project Director for two programs for International Paper Company to evaluate the potential risk of proposed solid waste management plans for paper mills in Arkansas and Mississippi. These programs included collection of waste, soil, and ground-water samples, analysis of the wastes, and batch extraction of the wastes followed by analysis of the leachates. In addition, leachates were generated and attenuated in waste and soil columns to evaluate the capacity of the subsoil to attenuate any leachate that might escape from the disposal site. A ground-water flow model was used to assess the rate and direction of contaminant movement if contaminants were to reach the water table.

Dr. Grimshaw was Technical Director for a generic environmental assessment of wastes from fluidized bed combustion for the U.S. Environmental Protection Agency (EPA). Emphasis was placed on potential hydrologic impacts. Both laboratory studies and field lysimeter tests were conducted in the study. The objectives were to identify and investigate key variables which determine the acceptability of FBC waste disposal and to establish a reliable empirical correlation between laboratory and field results so that better conclusions on field effects can be drawn on the basis of laboratory studies. Since the regulatory situation for FBC wastes was unclear during conduct of the program, provisions were made for both the eventuality that leachate migration will be allowed in the substrate below the landfill and that leachate escape will be controlled by liners. Interactions between leachate and representative disposal media and between leachate and several candidate liner materials were investigated in laboratory studies.

Dr. Grimshaw was also Technical Director for a program to investigate the ground-water impact of a spill of a coal-distillate liquid fuel at an SRC-II (Solvent Refined Coal) pilot plant at Fort Lewis Military Reservation near Tacoma, Pierce County, Washington. The study involved detailed coring to establish the location and extent of unsaturated zone con tamination and designing and constructing a set of ground-water monitoring wells to define the extent of ground-water contamination that had occurred. Analytical chemistry support was provided for Resource Conservation and Recovery Act (RCRA) Extraction Procedure testing of contaminated soils and for ground-water quality evaluation. A Remedial Measures Plan was formulated and implemented to remove

contaminated material and to prevent the further spread of ground-water contamination. This program involved extensive coordination and interfacing with the states regulatory authority (Washington Department of Ecology).

In a follow-up program for which Dr. Grimshaw was again Technical Director, Radian evaluated the overall hydrogeologic impact of the entire SRC plant in addition to the spill area. This program again involved soil sampling, extraction, and analysis as well as water quality monitor well installation and sampling. A zone of contamination was identified, and a comprehensive Remedial Measures Plan was prepared to address the problem.

In a program for Utah International, Incorporated, Dr. Grimshaw was responsible for evaluating the implications of RCRA on the company's mining operations under various regulatory scenarios. Special reference was made to UI's proposed Springer Mine which is in Pershing County, Nevada. Several issues concerning the application of RCRA regulations to metal mines emerged, including the applicability of the procedure for classifying solid waste as hazardous or non-hazardous.

Dr. Grimshaw was Technical Director for a project to investigate the environmental feasibility of disposing of flue gas desulfurization (FGD) wastes, ash and sludge, from a mine mouth power plant by backfilling into the associated surface mine in northwestern Colorado. He also had major supervisory and hydrogeologic interpretation roles in the second phase of the program, which included extensive field studies. These field studies included infiltration tests of the mine floor and overburden, water balance investigations to estimate ground-water recharge, and emplacement of piezometers to ascertain the direction of ground-water flow. A major output of this program was a rating of the various parts of the large surface mine in terms of suitability for ash and sludge disposal.

Dr. Grimshaw was a Task Leader in a program for the EPA ground-water laboratory (Robert S. Kerr Environmental Research Laboratory) to investigate a technique for identifying sources of nitrate ions in ground waters and soils using stable nitrogen isotopes. The usefulness of nitrogen isotope ratios for differentiating sources of nitrate pollution (septic tanks, feedlots, barnyards, and lands receiving municipal waste waters) was evaluated. Standard statistical techniques were used to analyze the observed variations in nitrogen isotope values, with respect to several nitrate-ion sources and various environmental factors.

For a comprehensive environmental assessment for Shell's Milam Mine near Rockdale, Texas in Texas, Dr. Grimshaw prepared and conducted an aquifer test program. These efforts included design of the pump wells and piezometers, layout of the well configuration in the field, oversight of well drilling operations, conduct of the two pump tests, and interpretation of the results in terms of the basic aquifer parameters. In another project related to this mine,

Thomas W. Grimshaw

Dr. Grimshaw was responsible for evaluating the potential effects on ground water resulting from disposal of ash and FGD solids from a power plant by emplacement of the wastes in the mine.

Dr. Grimshaw has directed or prepared parts of numerous multidisciplinary environmental investigations. The major projects of these type are as follows:

- EIS for Improvement of the City of San Antonio Wastewater Treatment System
- EIS for Upgrade of the City of Greensboro, NC Wastewater Treatment System
- EA for the Sandow Four Lignite-Fired Generating Station, Milam County, Texas
- Preliminary EA for a Proposed Lignite Mine in Henderson and Anderson Counties, Texas
- Hydrology-Related Regulatory Risks for Lignite Mining at the Deadwood-Shiloh Prospect, Texas and Louisiana
- EA for a Proposed Olefins Complex near Sweeney, Texas
- Environmental Audit of the Geokinetics In-Situ Oil Shale Operation, Uintah County, Utah
- Environmental Support Studies for a New Coal Gasification Facility at the Celanese Chemical Plant, Bishop, Texas
- Environmental and Reclamation Support Studies for a Proposed Lignite Mine in Freestone County, Texas

Prior to his employment by Radian Corporation, Dr. Grimshaw was employed as an oil and gas exploration geologist by Amoco Production Company, Denver, Colorado. Initially, he was a geologic field assistant near the coast of the Gulf of Alaska. This work entailed measuring, describing, and collecting stratigraphic sections in the Tertiary rocks in the vicinity of Cordova and Cape Yakataga, Alaska. Subsequently, Dr. Grimshaw was involved in a gas and petroleum exploration program in north central Montana. Most of the effort was in working out the stratigraphy and structural geology in the area of investigation, and he served for a time as well-site geologist on gas exploration wells. In addition, he launched a program of regional exploration in a much larger area in Montana. This work included study of down-hole geophysical logs, preparation of structural contour maps, and assembly of isopachous maps.

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Thomas W. Grimshaw

HONORARY AND PROFESSIONAL SOCIETIES:

Sigma Xi, Phi Kappa Phi, Sigma Tau, Sigma Gamma Epsilon, Geological Society of America, American Association of Petroleum Geologists, Association of Engineering Geologists.

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RICK A. BELAN

EDUCATION:

M.S., Hydrology, University of Arizona, Tucson, 1972.

B.S., Geology, Kent State University, Ohio, 1970.

EXPERIENCE:

Staff Hydrogeologist, Radian Corporation, 1980-Present.

Groundwater Hydrologist, William F. Guyton and Associates, 1977-1980.

Captain, United States Army, 1972-1977.

Environmental Impact Assessment Officer, United States Army, 1975.

Research Associate, University of Arizona, 1970-1972.

FIELDS OF EXPERIENCE:

Mr. Belan is currently the field investigation director for the Installation Restoration program at Sheppard Air Force Base, Texas; and is also acting as the technical advisor to the overall project. The investigation is being conducted at 4 inactive hazardous waste sites, and entails the emplacement of 14 monitor wells and 3 coreholes about these sites. These are to obtain soil and groundwater samples for chemical analyses. The results will be used to determine the environmental impact of the waste sites on the local groundwater systems.

Reports indicated the possible existence of groundwater contamination off base at McClellan Air Force Base, California. This large hydrogeological program was to investigate the present groundwater conditions. As the geologic evaluation task leader for the project Mr. Belan designed, coordinated and supervised the field activities for 29 reconnaissance borings. This required the drilling and sampling (soil and groundwater) to a depth of about 200 feet at selected sites off base. Selected chemical analyses were performed to maximize the hydrogeological information under this program. These borings were successfully completed ahead of schedule under difficult field conditions and project constraints.

As the Project Director Mr. Belan assisted a commercial client as part of litigation activities in developing groundwater sampling protocols which were then implemented under the direct field supervision of him. Two groundwater sampling episodes were conducted at the client's California site. The samples were obtained from a number of monitor wells for selected organic, inorganic and bacteriological analyses.

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Rick A. Belan

In Maryland an underground gasoline storage tank had leaked into the subsurface which was located in an urban downtown area. Mr. Belan as the principal investigator conducted an on-site visit and data review to confirm the nature and amount of the gasoline leak, assess the impact on the local hydrogeological setting, and possible safety implications. The results were documented along with recommendations for further evaluation of the leak.

A commercial client in southern California requested a geological evaluation of 10 inactive hazardous waste pits. Mr. Belan as the geological and safety task leader provided the coordination of coring activities through the waste bodies. This included obtaining soil, waste and air samples for chemical analyses from 10 coreholes. Full personnel protective clothing and respirator equipment were required for these activities.

Mr. Belan conducted field investigations of various hazardous waste sites at Kelly and Tinker Air Force Bases in Texas and Oklahoma, respectively. These efforts, as part of the Air Force's Installation Restoration Program (IRP), entail the installtion of monitoring wells and hazardous waste site soil sampling for chemical analysis. The results were used to define the site hydrogeology and waste site impacts, if any, on the local groundwater system.

Mr. Belan is the hydrogeological project director for an Installation Restoration Program investigating four hazardous waste disposal sites at Hill Air Force Base, Utah. The field phase entailed the direction of the investigation efforts for monitor well installation and completion, soil and groundwater sampling, geophysical resistivity surveys and chemical analysis coordination. The results of this effort were to determine the nature and extent of groundwater contamination and define the local hydrogeology.

As part of a remedial actions assessment of the McColl hazardous waste site in California, he conducted the conceptual design and evaluation of a slurry trench wall system. Containment wall materials were selected for laboratory testing. Additional wall materials and installation costing, survivability, and suitability were evaluated. Prior investigation at the site entailed the coordination and supervision of the air rotary drilling and casing drive completion of a 270-foot monitoring well. This upgradient well was drilled in difficult caving formations. The successful completion of this well permitted the location of a final downgradient monitoring well for the client.

Mr. Belan conducted, as part of a remedial actions assessment of the Lipari Superfund site in New Jersey, the conceptual design and costing of a dewatering system. This included an impact assessment of the formations dewatering on a slurry trench cutoff wall. The results of this evaluation provided discharge information for a groundwater treatability study.

He worked on three Environmental Protection Agency Superfund projects. Two projects entailed the hydrogeological evaluations of hazardous waste sites in Louisiana and New Jersey with the results developing and supporting site

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remedial measures activities. The third EPA Superfund activity was the evaluation of a new potential waste isolation technology which had been tested. The test attempted to isolate a large block of soil by slurry injection at depth areally and vertically using a patented process. Mr. Belan supervised the site investigation for determining the success of the technique to isolate the soil block. This entailed directing a geophysical survey, and confirmation soil borings to determine the soil isolation success of the test and report documentation.

In the area of solid waste management, Mr. Belan coordinated, supervised, and documented the disposal of fluidized bed combustion byproducts from a synfuels experiment sponsored by the Environmental Protection Agency. This project entailed the coordination with local agencies for the disposal at an appropriate landfill, and hydration of the wastes to neutralize its exothermic reaction prior to disposal.

Mr. Belan was instrumental in providing a hydrogeological assessment of an inactive hazardous waste site in south central New York. The site is listed by EPA as a priority site for action under Superfund. The result of the assessment was the design and costing of a monitoring well program for the client.

As the environmental baseline task leader and geological/hydrogeological team member, Mr. Belan coordinated, developed and identified environmental constraints or issues for a New Mexico Synfuels Project Feasibility Study. Analysis for this study for an industrial client permitted enumeration of groundwater and surface-water environmental issues associated with two in-mine and two plant sites disposal of hazardous/nonhazardous solid waste from a synfuels plant. The results of the study summarized the regional and site-specific geology, groundwater and surface-water. The study identified mine and plant environmental constraint areas concerning solid and liquid waste disposal and also described the waste disposal options as to which mine or plant sites the solid waste should go.

Mr. Belan conducted as part of a geothermal feasibility study a hydrogeological assessment of two aquifers for potential utilization for each of four U.S. military bases which are located in the vicinity of San Antonio, Texas. This entailed the development of conceptual well depths, productivity estimates, static water levels, water temperatures and water quality. These data were used to support benefit/cost analyses of a total geothermal systems package that included costs of well completion and production, heat extraction systems and projected heat demands.

He completed a state-of-the-art review of geopressured/geothermal fluids disposal technologies and environmental problems associated with the disposal techniques for the Texas Energy and Natural Resources Advisory Council (TENRAC). The two primary disposal methods reviewed were injection wells and

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surface discharge. From this study, Mr. Belan developed areas of geopressured/geothermal fluids gaps to commercialization. This review and subsequent recommendations provided TENRAC with a means to evaluate Texas geothermal/geopressured development especially towards commercialization and of potential technology areas that merit further study with public funds.

Mr. Belan conducted a preliminary assessment of the feasibility of utilizing a deep injection well for disposal of hazardous waste fluids from a prospective lignite gasification plant in East Texas. This entailed identifying aquifer parameters and computing long-term injection affects in order to assess two candidate aquifers for potential injection horizons.

As a staff hydrogeologist at Radian, Mr. Belan has experience in a wide range of groundwater sampling and analysis efforts. He was the field task leader and hydrogeological analyst for an environmental constraint study of a Lurgi coal gasification plant in East Texas. The study was to be the basis of a solid waste management plan for the plant site and the selection of a solid waste disposal site. It provided the client with supporting information to be used in obtaining state permits. Mr. Belan was the task leader for coordinating the air quality, ecology, surface water, and cultural impact portions of the reports, and developing future site-specific environmental studies requirements.

Mr. Belan analyzed aquifer testing methods and parameter data for an in-situ coal gasification project in Wyoming providing regional and vertical characteristics of the coal and overburden aquifers. The results became part of a relicensing application prepared for the U.S. Department of Energy, Laramie, Wyoming.

At refinery waste disposal sites in the area of Kenai, Alaska, Mr. Belan conducted a hydrogeological evaluation. This entailed the field supervision and interpretation of the drilling, geologic sampling, construction, and groundwater sampling of monitor wells in and around the disposal sites. The data obtained was used to define the local groundwater systems, subsurface geology, and establish if any groundwater contamination had occurred.

Mr. Belan directed and conducted the production and injection testing of two geothermal wells at Navarro College, Corsicana, Texas; one well was to supply geothermal fluid for heat extraction and the other will be used for disposal of the same fluid. He analyzed the test data for well performance, and aquifer parameters; providing a report and recommendations before final geothermal system design.

Mr. Belan, at Radian, conducted an impact assessment of groundwater availability and development quantitatively and qualitatively for a proposed petrochemical complex near the Texas Gulf Coast. His work involved developing

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a hypothetical well field for producing 6,900 gallons per minute and assessing the groundwater effects with time for varying aquifer conditions. Mr. Belan analyzed the local groundwater qualities to establish present baselines and if sufficient quality plant water could be available for use by the proposed plant.

He assisted in the preparation of the geology and groundwater hydrology sections of an Environmental Information Document for a proposed lignite mine in East Texas. He worked extensively on the supervision of the drilling, electrical logging, sampling, and construction of the test and monitor wells associated with this program with his former employer and, presently, with Radian prepared the study results for inclusion into the report.

As a groundwater hydrologist with W. F. Guyton and Associates, Mr. Belan provided hydrogeological field support for an overland liquid disposal facility for a client in Louisiana. In order to define the hydrogeology in and around the disposal facility, Mr. Belan provided the field supervision and interpretation of the mud rotary drilling, logging, completion, development, and groundwater sampling of a series of monitor wells. This information aided in defining what impacts, if any, the overland disposal would have on the local groundwater system.

Also while Mr. Belan was working for W. F. Guyton and Associates, his varied field tasks took him to Arizona, Nevada, and Texas. He assisted three large utility power companies in the field supervision of the drilling, geophysical logging, construction, pump and aquifer testing, and water quality sampling of over twenty large production water wells along with a number of observation wells. These wells were drilled on the different jobs by cable tool, mud rotary, and reverse drilling methods. These activities were summarized in well completion reports.

Mr. Belan completed with Mr. Guyton an in-depth analysis of the hydrogeology of the property of Texas Electric Service Company for Texas Utilities Services, Inc. for a prospective water supply, along with a well inventory of property outside the client's area of interest. During this study proposed water well field proposal consisting of 38 production water wells for a projected new electrical generating station. This study included estimated pumping rates, depths of wells, and estimated initial water quality for the well field.

As an officer in the United Stated Army stationed in West Germany in 1975, Mr. Belan initiated, developed and provided Environmental Impact Assessments (EIA) for the U.S. Frankfurt Military Community, and initiated research for 44 U.S. military installations throughout West Germany, which were to be included in the Frankfurt Master Plan. These studies were to define the environmental problems, if any, of the military installations for remedial measures planning

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and budgeting. His earlier duties included terrain/soils trafficability studies and weather analysis, and the supervision, evaluation, and distribution of tactical information.

As a Graduate Research Assistant in the Department of Soils, Water and Engineering at the University of Arizona, Mr. Belan was responsible for the planning, research, development, and quantifying of Mountain Front Recharge of the Tucson Santa Catalina Mountains under the supervision of his thesis director. The results of the study were published in an Arizona Water Resources periodical.

HONORARY AND PROFESSIONAL SOCIETIES:

Certified Professional Geological Scientist (American Institute of Professional Geologists), Technical Division National Water Well Association, Society of Petroleum Engineers, Sigma Gamma Epsilon Geology Honorary.

PUBLICATIONS/REPORTS:

Pearce, E.W., et al. Installation Restoration Program, McClellan AFB, California, Phase II, Stage 2-1, Radian Corporation, Austin, Texas, 1984 (Task leader for off base hydrogeological evaluation).

Radian Staff, Installation Restoration Program, Phase II, Stage 1, Field Evaluation, Kelly AFB, Texas, Radian Corporation, Austin, Texas, 1984.

Radian Staff, Installation Restoration Program, Phase IIB, Field Evaluation, Tinker AFB, Oklahoma, Radian Corporation, Austin, Texas, 1984.

Belan, R.A., Summary of CCSC Site Visit and Findings, Vicinity of Baltimore, Maryland, Radian Corporation, Austin, Texas, 1984 (Principal investigator).

Radian Staff, Summary of February 1984 Groundwater Sampling and Analytical Results, Radian Corporation, Austin, Texas, 1984 (Project director).

Radian Staff, Summary of March, 1984, Groundwater Sampling and Analytical Results, Radian Corporation, 1984 (Project director).

Belan, R.A., S.D. Lessley and H.P. Ross, Hill AFB, Utah, Installation Restoration Program, Phase IIB, IRP Survey - Final Report, UBTL Division of University of Utah Research Institute, Salt Lake City, Utah, 1984 (Project director for hydrogeological investigation).

Belan, R.A., Summary of Extended Water Level and Oil Thickness Measurement Program Vicinity of Chemical Disposal Pits Nos. 1 and 2 Hill AFB, Utah, Radian Corporation, Austin, TX, 1984.

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Belan, R.A., Hill Air Force Base, Utah Installation Restoration Program Phase II Hydrogeological Field Investigation, Volumes I, II, and III Draft Report, Radian Corporation, Austin, TX, 1983.

Belan, R.A., W.M. Little, and R. Glaccum, Geophysical and Soil Boring Field Test Evaluation of Block Displacement Method, Whitehouse, Florida, Radian Corporation, Austin, TX, and Technos, Inc., Miami, FL (Published and presented paper at National Water Well Association Technical Conference, St. Louis, MO, 1983).

Stein, N.P., et al., Treatability Study of Contaminated Ground Water from the Lipari Landfill, Pitman, New Jersey - Draft Report, Radian Corporation, 1983 (Developed the hydrology assessment section on the remedial action impacts and costs of a dewatering system).

Belan, R.A., W.M. Little, and R. Glaccum, Draft Report Foster-Miller Test Site Evaluation, Radian Corporation, Austin, TX, and Technos, Inc., Miami, FL, 1982.

Radian Staff, Remedial Action Alternatives for the McColl Site, Fullerton, California, Radian Corporation, Austin, TX, 1983 (Conducted the remedial action assessment and materials selection for a slurry trench wall system).

Radian Staff, Geothermal Resource Evaluation in the Area of Coso Hot Springs KGRA (exact title client confidential), Radian Corporation, Austin, TX, 1983 (Evaluated geothermal reservoir testing results).

Radian Staff, Technical Review of Reports on Two Hazardous Waste Sites Near Baton Rouge, Louisiana, Austin, TX, 1982 (Developed report evaluation criteria and reviewed reports on hydrogeological investigation results.)

Ajmera, K.T., W.F. Holland, N.P. Stein, R.A. Belan, and L.J. Holcombe, A Report on Waste Disposal/Hydrology Study New Mexico Synfuels Project, Radian Corporation, Austin, TX, 1982 (Environmental task leader, document editior, authored activity impacts and hydrogeological sections).

Belan, R.A., J.C. Lippe, and J.P. Rossi, An Overview of Regional Geology and Hydrology for Solid Waste Disposal Study, Radian Corporation, Austin, TX, 1982 (Environmental task leader and authored geological and ground-water sections and document editor).

Radian Staff, Volume I Final Report Life Cycle Cost-Effectiveness Studies for Direct Utilization of Geothermal Energy at Four Military Installations in South-Central Texas, Austin, TX, 1982 (Authored hydrogeological parameter development and environmental considerations).

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Belan, R.A., K.T. Ajmera, An Overview of Earth Resistivity Surveys - Technical Memorandum, Radian Corporation, Austin, TX, 1982.

Belan, R.A., Technical Note, ETSP Soil Samples for Attenuation Capacity Analysis, Radian Corporation, Austin, TX, 1981.

Belan, R.A. and K.T. Ajmera, Technical Note, ETSP Preliminary Geotechnical and Surface Water SWMP Related Field Studies and Preliminary Layout of Solid Waste Disposal Site, Radian Corporation, Austin, TX, 1981.

Belan, R.A. and A.F. Ferguson, Geothermal Injection and Production Well Test Results: Project Title - Water and Space Heating for a College and Hospital by Utilizing Geothermal Energy, Radian Corporation, Austin, TX, 1981.

Belan, R.A., et al., Summary of the ETSP Solid Waste Disposal Area Selection and Trade-Offs, Radian Corporation, Austin, TX, 1981.

Belan, R.A., et al., Summary of Findings for the Fatal Flaw Assessment of the Northern Area, Radian Corporation, Austin, TX, 1981.

Belan, R.A. et al., Technical Note, Environmental Constraint Screening of Mine Property and Surrounding Areas for Solid Waste Disposal Siting near Troup, Texas, (Environmental section Task Leader and authored ground-water section), Radian Corporation, Austin, TX, 1981.

Radian Staff, Relicensing Application - Hanna Experimental In-situ Coal Gasification Project, Hanna, Wyoming, (Provided analysis of supplied aquifer parameter values pertaining to regional and vertical distributions and ranges of applicability), Radian Corporation, Austin, TX, 1981.

Radian Staff, Compilation of Environmental Information for a Proposed Olefins Complex, Brazoria County, Texas, (Author of ground-water baseline and development), Austin, TX, 1981.

Radian Staff, Evaluation of Hydrogeology and Waste Management Options at Tesoro Alaska Petroleum Company's Kenai, Alaska Refinery, (Author of hydrogeology section), Austin, TX, 1980.

Guyton, W.F., R.A. Belan, and W. Stevens, Report on the Ground-Water Availability for Prospective Coal-Fueled Electric Generating Station in Ward County, Texas, W. F. Guyton and Associates, Austin, TX.

R.A. Belan authored a number of Environmental Impact Assessments for U.S. Military Installations for the Department of the Army, Federal Republic of Germany.

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E. WAYNE PEARCE

EDUCATION:

M.S., Geology, University of South Florida, 1984.

B.S., Geology, Florida Atlantic University, 1976.

EXPERIENCE:

Hydrogeologist, Radian Corporation, Austin, TX, 1980-Present.

Hydrogeologist, Edwards Aquifer Research and Data Center, 1980.

Hydrogeologist, Geraghty & Miller, Inc., 1977-1980.

FIELDS OF EXPERIENCE:

At Radian Corporation, Mr. Pearce has served as a hydrogeologist in the Environmental Analysis Department. Duties included project direction and team member responsibilities.

As a project director, Mr. Pearce has had responsibility for technical quality, budget controls, and scheduling for major projects, primarily in the investigation and mitigation of hazardous waste disposal sites. Among these projects, Mr. Pearce directed the geotechnical investigation and waste sampling efforts at the McColl waste site in southern California. Related to the same project, Mr. Pearce also directed the proposal effort, authored several reports on the site, assisted in the remedial action cost-effective evaluation and recommendation, and directed the field effort that demonstrate the recommended remedial action was feasible and could be accomplished safely.

In a similar California project for an industrial client, Mr. Pearce directed a project which investigated a disposal site on the client's property. The unstable site required special supports for drilling activities and personnel. The project included waste sampling areally and vertically to define the site characteristics, soil sampling below the waste, undisturbed site emissions monitoring, disturbed waste emissions monitoring, ground-water monitoring well installation and sampling, and investigation of other suspected disposal areas on-site. A remedial action is currently being developed for this site.

Other projects include:

- Design of the conceptual ground-water remedial action plan for the Lipari Landfill at Pittman, New Jersey. This is the number one Superfund site in the country and remedial measures are currently underway.

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E. Wayne Pearce

- Waste exploration and remedial action design for a major refinery in Louisiana where over 1 million cubic yards of hazardous wastes have been improperly disposed.
- Site investigation and analysis of an abandoned chemical dump site in Louisiana. Over 130 coreholes were drilled to sample wastes, soils, and ground water.
- Various studies which included ground-water modeling activities associated with waste disposal facilities, underground coal gasification, and water supply projects. Modeling experience with both advection/dispersion models and mass-transport models.

For hazardous waste site investigations, Mr. Pearce has played a key role in developing safety plans and selecting appropriate safety equipment. This equipment includes full- and half-face respirators, positive pressure air-supplied suits, self-contained breathing apparatus, passive and active personnel monitoring (dosimeters), and a wide range of support equipment.

At Geraghty & Miller, Mr. Pearce served as a hydrogeologist on contamination studies and water supply projects. These included:

- A major chemical contamination in Michigan;
- Red mud contamination at an alumina-bauxite facility in Jamaica;
- Water supply for an electric generating station in Puerto Rico;
- Installation of five municipal effluent disposal wells for the City of West Palm Beach (up to 72" diameter wells - 3700 feet deep);
- Salt water intrusion studies in Florida; and
- Various other hydrologic studies.

PROFESSIONAL ACTIVITIES:

National Water Well Association, Technical Division; Certified Professional Geological Scientist, American Institute of Professional Geologists #6164.

PUBLICATIONS:

Hoskings, T.W. and E.W. Pearce, "Waste Exploration and Chemical Analyses for the Ellender Ferry Waste Disposal Site," Radian Report to confidential industrial client, May 1981.

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E. Wayne Pearce

Pearce, E.W., C.R. Stallings, et al., "Hydrologic Assessment, Hanna Experimental In-Situ Coal Gasification Project," Radian Corporation report to U.S. Department of Energy, Laramie Energy Technology Center, February 1981.

Gutierrez, Gormley, Hoskings, Pearce, "Hazardous Waste Disposal Options, Costs and Disposal Site Evaluation for Coal Gasification/Liquefaction Facilities," Radian Corporation report to U.S. Department of Energy, December 1980.

Little, W.M., E.W. Pearce, et al., "Ground-Water Impact of SRC Pilot Plant Activities, Fort Lewis, Washington," Radian Corporation Report to SRC International, January 1981.

Little, W.M., E.W. Pearce, and H.J. Williamson, "Ground-Water Modeling at an In-Situ Coal Gasification Test," Radian Corporation report to confidential industrial client, September 1980.

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RADIAN CORPORATION

WILLIAM M. LITTLE

EDUCATION:

M.S., Civil Engineering, University of California, Berkeley, 1974.

M.S., Hydrology, University of Arizona, Tucson, 1968.

B.S., Hydrology, University of Arizona, Tucson, 1967.

EXPERIENCE:

Senior Engineer and Group Leader, Radian Corporation, Austin, TX, 1982-Present.

Senior Engineer, Radian Corporation, Austin, TX, 1978-1982.

Hydrologist, U.S. Army Environmental Hygiene Agency, 1973-1978.

Research and Technical Operations Officer, U.S. Army Engineer Nuclear Cratering Group, 1969-1971.

Graduate Student in Research, University of Arizona, Tucson, 1968.

FIELDS OF EXPERIENCE:

Mr. Little is a Senior Engineer and Group Leader with a major technical specialty in ground-water pollution studies. He is currently the Project Director for hydrogeologic investigations of multiple waste disposal sites on Tinker Air Force Base, Oklahoma. He has recently completed a similar investigation for Kelly AFB, Texas. These investigations include monitoring well construction, ground-water sampling, and contaminant transport assessment. He is responsible for program design and execution, subcontractor selection, and managing and editing the final report. He is also providing technical consulting and expert witness services for a hazardous waste site cleanup case in Kansas City, Missouri.

Mr. Little has recently completed a hydrogeologic investigation of a Superfund site in western New York state. The project included monitoring well construction, definition of ground-water flow system, assessment of contaminant transport potential, and presentations to regulatory authorities. Mr. Little served as Project Director and principal investigator. He has also served as Project Director and field manager for a large, multidisciplinary characterization of an abandoned hazardous waste disposal site in southern California. The waste materials consist of acid petroleum refinery sludges. Major areas of investigation were: chemical characterization of wastes and geologic materials; quantification of sulfur dioxide and hydrocarbon emissions; and ground-water monitoring. Mr. Little was responsible for managing the field operations and supervising report preparation.

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Mr. Little has served as assistant Project Director and field manager for an investigation of the ground-water quality impact of a spill of a coal-distillate liquid at an SRC pilot plant near Tacoma, Washington. The study involved detailed unsaturated zone coring and designing and constructing a series of ground-water monitoring wells A Remedial Measures Plan was formulated and adopted to remove contaminated materials and to prevent the further spread of ground-water contamination. Following the evaluation of the spill event, Mr. Little directed an expanded program to evaluate the ground-water quality effects of overall plant operations. The possible sources of contamination were identified and characterized. Mr. Little then developed a ground-water monitoring program and supervised the installation of the monitoring network. He designed and conducted aquifer pump tests to define aquifer performance and interpreted the results.

Mr. Little has also conducted a program to evaluate the extent of ground-water contamination by refinery operations and wastes at an oil refinery near Duncan, Oklahoma. The assessment was based on site reconnaissance, interviews with refinery personnel and a study of existing hydrogeologic and process data.

Mr. Little has recently completed two environmental/regulatory fatal flaw studies for lignite mines and associated power plants in East Texas. He was both Project Director, responsible for overall management and preparation of the final report, and hydrology task leader, responsible for assembling data on hydrologic conditions and assessing probable impacts. He has also recently served as task leader for regulations review, impact analysis and permit application preparation for a commercial-scale coal gasification facility in Wyoming and ground-water hydrology task leader for environmental analysis of a major lignite mine and associated synfuels plant in east Texas.

In another program, Mr. Little directed an evaluation of surface-water and ground-water availability in the vicinity of the proposed Solvent Refined Coal-II (SRC-II) demonstration plant and commercial facilities near Morgantown, West Virginia.

For a private industrial client, Mr. Little reviewed and evaluated the environmental monitoring data from the vicinity of an in situ coal gasification test in the Powder River Basin of Wyoming. The water quality impacts of the test burn were assessed, and a program of aquifer restoration and hydrologic testing recommended. Based on available hydrologic and geochemical data, a conceptual model of the test site was developed. He also developed a ground-water monitoring and contingency aquifer restoration program for a proposed future test. The program includes selection of well locations and parameters for monitoring and specification of restoration strategies.

Mr. Little has also participated in an assessment of the environmental behavior of fluidized bed combustion (FBC) waste for EPA, IERL. Mr. Little was responsible for the design, construction and operation of field cells for

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William M. Little

testing FBC waste disposal alternatives and for the development of a preliminary waste transport model. He has also been project director and hydrology task leader in the evaluation of the environmental suitability of an ash/scrubber sludge disposal site. He was responsible for the overall management of the program, evaluated the laboratory and hydrogeologic data and predicted contaminant migration.

As a hydrologist with the Water Quality Engineering Division, U.S. Army Environmental Hygiene Agency, Mr. Little served as a consultant to the Office of the Surgeon General and to major commands and installations on hydrologic aspects of water supply and wastewater disposal. He prepared design criteria for programs of effluent and receiving water monitoring at Army manufacturing and research facilities, evaluated ground-water pollution potential of waste disposal practices, and reviewed draft NPDES discharge permits issued to Army installations. He performed preliminary technical feasibility studies of land treatment of wastewater including field investigations and trial systems design. He conducted environmental impact statement data requirements review and prepared and reviewed portions of environmental impact statements. Mr. Little also managed the Army Medical Department's nationwide Drinking Water Surveillance Program.

With the Corps of Engineers, Mr. Little was assigned as a Research and Technical Operations Officer, U.S. Army Engineer Nuclear Cratering Group. There he conducted a general investigation of hydrologic transport of radionuclides from Plowshare application sites. This work included literature searches, computer simulation, experimental design and conceptual modeling of transport phenomena. He also participated in final preparation of a 1971 Corps of Engineers report on Wastewater Management in the San Francisco Bay Region.

While at the University of Arizona, Mr. Little was a member of the Operations Research Study Group on the Tucson Basin, gathering background hydrologic material, and conducting a literature and data file search. He directed and participated in preliminary adaptation of a two-dimensional, finite difference model of a large, heterogeneous ground-water basin.

HONORARY AND PROFESSIONAL SOCIETIES:

American Geophysical Union, American Water Resources Association, National Water Well Association, Sigma Xi.

CERTIFICATION:

AIPG Certified Professional Geological Scientist No. 6468.

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William M. Little

PUBLICATIONS/REPORTS:

Numerous technical reports in the fields of water resources development, ground-water contaminant migration, occurrence of radionuclides in ground water, land treatment feasibility and receiving water monitoring, including:

Little, W.M., et al., "Installation Restoration Program, Phase II - Confirmation/Quantification, Stage 2, Tinker AFB, Oklahoma," Radian Corporation, Draft Report to U.S. Air Force, December 1984.

Little, W.M., et al., "Installation Restoration Program, Phase II - Field Evaluation, Stage 1, Tinker AFB, Oklahoma," Radian Corporation, Draft Final Report to U.S Air Force, November 1984.

Little, W.M., et al., "Installation Restoration Program, Phase II, Stage 1, Field Evaluation, Kelly AFB, Texas," Radian Corporation, Final Report to U.S. Air Force, July 1984.

Little, W.M., "Hydrogeologic Investigations, Facet Enterprises, Inc., Elmira, New York," Radian Corporation Final Report to Facet Enterprises, Inc., September 1983.

Little, W.M., et al., "McColl Site Investigation - Phase 1," Radian Corporation Report to the Participants Committee, November 1982.

Little, W.M., et al., "Environmental Considerations and Air Quality Modeling for the Freestone County Project," Radian Corporation Report to Tenneco Coal Company, March 1982.

Grimshaw, T.W., et al., "Assessment of Fluidized-Bed Combustion Solid Wastes for Land Disposal," Draft Final Report, Radian Corporation Report to EPA Industrial Environmental Research Laboratory, December 1982.

Little, W.M., et al., "Environmental Considerations and Air Quality Modeling for the Edgewood and Mustang Creek Prospects and Associated Energy Park," Radian Corporation Report to Tenneco Coal Company, November 1981.

Little, W.M., et al., "Ground-Water Impact of SRC Pilot Plant Activities Fort Lewis, Washington," Radian Corporation report to Gulf Mineral Resources Company, January 1981.

Little, W.M., et al., "Ground Water Modeling at an In-Situ Coal Gasification Test," Radian Corporation Report to confidential industrial client, September 1980.

Little, W.M. and H.J. Williamson, "Recommended Ground-Water Monitoring and Aquifer Restoration Programs, Future In-Situ Coal Gasification Test," Radian Corporation Report to confidential industrial client, September 1980.

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William M. Little

Little, W.M. and W.C. Micheletti, "Recommended Aquifer Restoration and Hydrologic Testing Program for an In-Situ Coal Gasification Test," Radian Corporation Report to confidential industrial client, August 1980.

Grimshaw, T.W. and W.M. Little, "Remedial Measures Plan for a Spill of Solvent Refined Coal Liquid at the SRC Pilot Plant, Fort Lewis, Washington," Radian Corporation Report to Gulf Mineral Resources Company, August 1980.

Little, W.M., et al., "Hydrologic Evaluation of a Combined Ash/FGD Sludge Storage Site, Craig Station," Radian Corporation Report to Colorado Ute Electric Association, July 1980.

Little, W.M., T.J. Wolterink, and M.H. McCloskey, "Water Availability Appraisal for the Proposed Solvent Refined Coal-II Demonstration Plant, Monongalia County, West Virginia," Radian Corporation Report to U.S. Department of Energy, February 1980.

Little, W.M., "Water Quality Geohydrologic Consultation No. 24-0286-77," Twin Cities Army Ammunition Plant, New Brighton, MN, 21-23 July 1976, U.S. Army Environmental Hygiene Agency, 11 January 1977 (six additional geohydrologic consultations).

Little, W.M., Drinking Water Consultation Visit No. 24-1301-77, Joliet Army Ammunition Plant, Illinois, 2-4 August 1976, USAEHA, 9 February 1977 (four additional drinking water consultations).

Little, W.M., Water Quality Geohydrologic Consultation No. 24-058-75/76, Land Disposal Feasibility Study, Fort Polk, Louisiana, 2-29 April and 9-29 October 1975, USAEHA, 19 August 1976 (three additional land treatment evaluations).

Little, W.M., Water Quality Monitoring Consultation No. 24-048-74/75, Aberdeen Proving Ground, Maryland, 25-27 February 1974, USAEHA, 17 December 1974 (three additional monitoring consultations).

Little, W.M., Water Quality Engineering Special Study No. 24-017-74, Mixing in Receiving Waters, 7 September-24 October 1973, USAEHA, 3 January 1974.

Little, W.M., Analysis of Hydrologic Transport of Tritium, U.S. Army Engineer Nuclear Cratering Group Technical Memorandum 70-7, Lawrence Radiation Laboratory, Livermore, CA, April 1971.

Little, W.M., An Engineering and Economic Feasibility Study for Diversion of Central Arizona Project Waters from Alternate Sites, M.S. Thesis, Department of Hydrology, University of Arizona, Tucson, AZ, 1968.

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RADIAN
CORPORATION

PETER ALEXANDER WATERREUS

EDUCATION:

B.S., Geology, The University of Texas at San Antonio, San Antonio, TX, 1984.

EXPERIENCE:

Geologist, Radian Corporation, Austin, TX, 1984-Present.

Mud Logger, Precision Well Logging, Houston, TX, 1984.

FIELDS OF EXPERIENCE:

Mr. Waterreus is currently involved in the investigation and determination of a JP-4 fuel leak from existing underground pipelines at Bergstrom AFB, Austin, Texas. As supervising geologist, activities include safety supervision, logging borings, collection of soil samples, installation of monitor wells, collection of water samples, and reporting.

Mr. Waterrus also is currently involved in the investigation of hazardous waste contamination at Sheppard AFB, Wichita Falls, Texas. As a supervising geologist, activities include safety supervision, logging borings, collection of soil samples, installation of monitor wells, collection of water samples, monitoring possible types of contamination by use of a photo-ionizer and drager tubes, and reporting.

Mr. Waterreus was involved in the investigation of environmental impact related to gas and oil production in the Big Thicket area of East Texas. Activities includes delineation and mapping of active and non-active gas and oil well sites as well as damaged areas outside the site area.

At Precision Well Logging, he performed analyses of rock cuttings with respect to lithology and oil content as well as gas monitoring and identification.

He has also been involved in field mapping and property investigation in Uvalde County, Texas.

PUBLICATIONS:

Waterreus, P.A. and R.A. Wooster, "A Feasibility Study of Inducing Artificial Recharge to the Edwards Aquifer by Diversion of Floodwaters in Uvalde County, Texas," on record at the Edwards Underground Water District, San Antonio, Texas.

HONORARY AND PROFESSIONAL SOCIETIES:

Geologic Society of America.
Association of Ground Water Scientists and Engineers.

02/26/85

RADIAN
CORPORATION

JENNY B. CHAPMAN

EDUCATION:

M.A., Geology, The University of Texas at Austin, Austin, TX, 1984.

B.S., Geology, Sul Ross State University, Alpine, TX, 1981.

EXPERIENCE:

Geologist, Radian Corporation, Austin, TX, 1984-Present.

Research Assistant, The University of Texas Bureau of Economic Geology, Austin, TX, 1982-1984.

FIELDS OF EXPERIENCE:

At Radian, Ms. Chapman is involved in hydrogeologic and geologic studies, especially as they relate to hazardous waste contamination. Her responsibilities range from collecting and analyzing hydrogeologic and geologic data and samples to interpreting and reporting on the results of investigations.

Ms. Chapman recently participated in a field study at Carswell AFB. She supervised the installation of monitor wells in both alluvial deposits and in the regional aquifer. Drilling methods used include hollow-stem auger, mud rotary, and air rotary. She also supervised geophysical crews and participated in soil and water sampling. She is one of the primary authors of the project report.

Other recent projects include a study funded by the Electric Power Research Institute to locate and collect limestone samples for use in experiments concerning stack scrubber systems. In addition to identifying and collecting the samples, Ms. Chapman participated in laboratory grindability and insoluble residue experiments. In another project, she performed field work at the Big Thicket National Preserve to assess the environmental impact of oil and gas well drilling. Activities included delineation and mapping of active and nonactive gas and oil well sites as well as damaged areas adjacent to sites.

At the University of Texas Bureau of Economic Geology, Ms. Chapman wrote and edited contract reports for the West Texas Waste Isolation Project, studying the feasibility of storing high-level radioactive waste in Permian salt beds in the Texas Panhandle. She assisted in hydro- and geochemical research pertaining to WTWI, especially interpreting chemical analyses of water samples.

Ms. Chapman researched and wrote her master degree thesis on the hydrogeochemistry of the unsaturated zone. Her field work included the use of tensiometers, lysimeters, and neutron probes (moisture and density). Lab work included water and soil analysis using atomic absorption spectrophotometer, titration techniques, X-ray diffraction, and thin-section analysis.

04/29/85

RADIAN CORPORATION

Jenny B. Chapman

HONORARY & PROFESSIONAL/TECHNICAL SOCIETIES:

Sigma Gamma Epsilon, Alpha Chi.

PUBLICATIONS:

Chapman, J.B., "A Comparison of the Depositional Environmental of the San Andres Formation in the Palo Duro Basin to Recent Evaporitic Environments," The University of Texas at Austin, Bureau of Economic Geology, Open-file Report OF-WTWI-1984-1, 1984.

Kreitler, C.W., J.B. Chapman, and L.P. Knauth, "Chemical and Isotopic Composition of Waters from the Salina Ometepec, Baja, California," The University of Texas at Austin, Bureau of Economic Geology, Open-file Report, OF-WTWI-1981-41, 1984.

Chapman, J.E.B., "Hydrogeochemistry of a Salt Flat in Hudspeth County, Texas," The University of Texas at Austin, Master's Thesis, 1984.

04/29/85

JILL P. ROSSI

EDUCATION:

B.A. Geography, The University of Minnesota at Minneapolis, 1972.

EXPERIENCE:

Geographer, Cartographer, Policy and Environmental Analysis Division, Radian Corporation, Austin, TX, 1980-Present.

Drafting and Graphics Assistant, Dam Safety Unit, Texas Department of Water Resources, Austin, TX, 1979-1980.

Cartographer, Continental Map Inc., Austin, TX, 1978-1979.

Teaching Assistant, University College-Geology, University of Minnesota at Minneapolis, 1972.

FIELDS OF EXPERIENCE:

At Radian, Ms. Rossi is responsible for producing maps and coordinating graphics for the Environmental Analysis Division. She utilizes data from a variety of technical disciplines (geology, hydrology, noise and air monitoring, sociology, soils, and hydrogeology) to create maps which clearly and concisely illustrate the written text. Ms. Rossi has been responsible for work in the following projects:

- Develop base maps and coordinate graphics throughout an Environmental Impact Statement prepared for the U.S. Bureau of Land Management for a central Texas lignite mine;

- Develop color overlay method of mapping for site selection process of commercial waste disposal sites in Texas and southeastern Oklahoma;

- Develop a series of figures used as illustrations in a manual for the Environmental Protection Agency on Remedial Actions at Uncontrolled Hazardous Waste Sites:

- Draft maps and coordinate the graphics for an Environmental Impact Statement for a synfuels plant in Tennessee;

- Create base and thematic maps for Air Force Installation Restoration Programs (Phase I and Phase II) for the following locations: Kelly AFB, Texas; Hill AFB, Utah; Bergstrom AFB, Texas; Cannon AFB, New Mexico; England AFB, Louisiana; Tinker AFB, Oklahoma; and Reese AFB, Texas; Carswell AFB, Texas; Sheppard AFB, Texas;

Jill P. Rossi

- Map limestone deposits, lime plants, and limestone quarries in the United States by county in a series of regional maps for the Electric Power Research Institute;
- Map compliance/non-compliance with air pollution standards for all counties in the United States in a series of EPA regional maps;
- Map concentrations of selected air pollutants in the El Paso, Texas, area for a Texas Air Control Board study in a series of quarterly and annual reports;
- Prepare aerial photography history of a wood preserving plant for a commercial client which included extensive research of available aerial photography and interpretation of those photos to determine historical features of interest;
- Prepare complex permitting schedules for proposed mines, energy facilities, and hazardous waste handling facilities;
- Preparation of base and thematic maps for various feasibility studies, fatal flaw analyses, Environmental Information Documents, and Environmental Impact Statements;
- Identify, field verify, and map oil and gas development features within the Big Thicket National Preserve for the National Park Service; and
- Research of available map resources, aerial photography, remote sensing products, and mapping technologies as required by individual client needs.

While with the Texas Department of Water Resources, Ms. Rossi worked in the graphics section of the Dam Safety Unit, a federal grant program. She prepared maps and exhibits, and laid out phototypset text into camera-ready form according to standards, developed with her assistance, for the technical reports written by the engineering section.

During her employment with Continental Map Incorporated, Ms. Rossi was involved in all phases of four color map production. These included source information procurement and classification, imaging of base maps, scribing plates, cutting specialties, sizing and adhering type, designing customer copy panels, indexing streets and points of interest, photo-lab contact reproducing of base plates, and the final compositing of the four negative plates to be sent to the printer. These maps included large metroplex areas, counties, enlarged downtown sections, and simplified principle city thoroughfares.

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Jill P. Rossi

While employed by the University of Minnesota as a Geology Teaching Assistant, Ms. Rossi taught geology laboratory sessions, prepared geology lab work materials, tutored students, and assisted the professors by preparing classroom presentations and grading and proctoring exams.

02/07/85

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APPENDIX L

GEOPHYSICAL TRACINGS

No geophysical investigations were conducted for this IRP project.

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BERGSTROM AIRFORCE BASE

IRP

HEALTH AND SAFETY PLAN

Prepared by: Radian Corporation

TABLE OF CONTENTS

1.0 INTRODUCTION

This plan describes the safety and health procedures and practices for the accomplishment of IRP Field Evaluation to be conducted at Bergstrom AFB, Texas. All Radian employees and subcontractors to Radian will follow this plan unless situations encountered in the field make changes necessary. These changes must be approved by the Project Director.

Major site activities will consist of pipeline testing, soil coring and monitor well installation and ground water sampling.

The prime responsibility for employee safety will rest with: (1) Radian for it's own employees, (2) Radian subcontractors for their employees and (3) with other parties whose employees will work under Radian's technical direction.

Radian, it's subcontractors, and other parties participating in on-site work, will comply with all applicable requirements of the Occpational Safety and Health Administration. The waste material that will pose a risk to employees is fuel, or more specifically, JP-4 type fuel.

2.0 FIELD ACTIVITIES

The field work will consist of:

- o Pipeline testing
- o Soil coring in the vicinity of building 4544 (Bergstrom Flight Tower)
- o Monitoring well installation
- o Well sampling

2.1 Key Personnel

The Radian personnel who will be responsible for the safe operation of this project are:

- o Program Manager: Tom Grimshaw
- o Project Director: Wayne Pearce and Rick Belan
- o Supervising Geologists: Rick Belan and Peter Waterreus
- o Drilling Supervisor: Robert L. Sherrill and Pat Goodson

The responsibilities of the Project Director with respect to safety are as follows:

- Locate support facilities in an uncontaminated area.
- Initiate contact with the Base Safety Officer and test the emergency phone numbers to ensure their accuracy.
- Implement the site safety training program as described in this plan.
- Observe site activities to ensure the proper use of personal protective equipment.
- Initiate outside emergency phone calls when an injury or accident requires medical attention.
- Ensure that work schedules , dependent on work levels and outside temperatures, are set each day and adhered to though-out the work day.
- Ensure that the field team observes the work zone and decontamination procedures.
- Ensure that safety equipment is maintained in a safe manner.
- Report violation and compliance problems to the Corporate Safety Office in Austin (512-454-4797 ext. 5763, Andrew Ellis).

The responsibilities of the Drilling Supervisor with respect to safety are as follows:

- Drilling crew compliance with the health and safety plan.
- Enforcement of corrective action under the direction of the Radian Project Director. Compliance problems will be brought to the attention of the Drilling Supervisor who will be expected to correct the safety problem through a series of reprimands, eventually resulting in the dismissal of the offending employee.

The responsibilities of the Radian Corporate Safety Staff are as follows:

- Prepare a health and safety plan for the project.
- Perform a job safety analysis.
- Select appropriate personal protection equipment.
- Define appropriate workplace exposure monitoring procedures.
- Develop of a contamination control program.

- Develop a plan to cope with anticipated emergencies.

The responsibilities of the field team members are:

- Read and understand this plan.
- Perform your work safely.
- Report any unsafe condition to your supervisor.
- Be aware and alert for signs and symptoms of exposure to site contaminants.

3.0 JOB SAFETY ANALYSIS

The field work will involve some risk to the employee. The major site hazards are:

- exposure to petroleum products by way to the skin and respiratory system
- exposure to physical hazards associated with drilling activities

The personal protective equipment specified below has been selected to reduce the risk of exposure to site hazards.

3.1 Pipeling Testing

Pipeling testing activity will be conducted using up to the personal protective equipment, as determined by the supervising Geologist, listed below:

- tyvek coveralls
- Gauntlet style, chemical resistant, neoprene gloves
- Chemical resistant, steel toed, stell shank, safety boots, (PVC or Neoprene)
- Respirator, half-face or full-face piece, air purifying, equipped with organic vapor cartridges and dust filters;
- Safety helmet

3.2 Soil Coring

Soil coring activity will be conducted using the personal protective equipment listed below:

- tyvek coveralls
- Gauntlet style, chemical resistant, neoprene gloves
- Chemical resistant, steel toed, stell shank, safety boots, (PVC or Neoprene)
- Respirator, half-face or full-face piece, air purifying, equipped with organic vapor cartridges and dust filters;
- Safety helmet

3.3 Monitor Well Installation

The personal protective equipment listed below will be used during the installation of monitoring wells.

- tyvek coveralls
- Gauntlet style, chemical resistant, neoprene gloves
- Chemical resistant, steel toed, stell shank, safety boots, (PVC or Neoprene)
- Respirator, half-face or full-face piece, air purifying, equipped with organic vapor cartridges and dust filters;
- Safety helmet
- Hearing protection

3.4 Well Sampling

The field team will use the equipment listed below when collecting well samples:

- tyvek coveralls;
- Gauntlet style, chemical resistant, neoprene gloves;
- Chemical resistant, steel toed, stell shank, safety boots, (PVC or Neoprene);
- Respirator, half-face or full-face piece, air purifying, equipped with organic vapor cartridges and dust filters;
- Safety helmet; and
- Hearing protectors (rotary drilling rig).

Depending on site conditions and drilling conditions, other items may be used for supplemental protection. Such items may include:

- o PVC bib overalls and jacket (especially for drillers handling auger flights that have contacted waste material;
- o Respirator, half-face piece, air purifying equipped with organic vapor cartridges and dust filters (used only when where there is no eye irritating chemicals, splashes, or projectiles in the work environment) YOU MUST USE EYE PROTECTION WITH HALF FACE RESPIRATORS;
- o Chemical splash goggles when splash hazards exist (steam cleaning especially); and
- o PVC disposable gloves to be worn outside of the neoprene gloves for extra protection.

3.5 Other Potential Hazards

The site may contain other hazards that are not described above. The Supervising Geologist will make an assessment of the site hazards prior to starting work and ensure that the field team is protected. Two hazards which may be encountered are:

- o heat stress
- o drilling into underground hazards (buried drums, cylinders, electrical cables, etc.)

Heat Stress

During work, the Supervising Geologist must be alert for the signs and symptoms of heat stress. A hazard exists when employees are required to work in warm temperatures while wearing impervious protective clothing. When ambient air temperatures at the site exceed 65 degrees F, heat stress may become a problem. If these conditions are encountered, the following precautions will be taken:

- o The Supervising Geologist will regularly monitor the ambient air temperature;
- o Field team members will be observed for the following signs and symptoms of heat stress:
  - Dizziness
  - Profuse sweating
  - Skin color change
  - Increased heart rate

- Abnormal body temperature as measured by fever detectors (forehead straps)
- vision problems

Any employee who exhibits any of these symptoms will be immediately removed from field work and requested to consume 2-4 pints of electrolyte fluid or cool water every hour while resting in a shaded area. The worker should not return to work until symptoms are no longer recognizable. If the symptoms worsen, seek immediate medical attention.

<u>Drilling Into Buried Hazards</u>

During the planning/mobilization phase, the Supervising Geologist should consult with base personnel about the location of utility lines. Prior to penetrating the soil, ask knowledgeble site employees about the possibility of buried drums or gas cylinders. If drilling cuttings indicate any signs of drums or cylinders, cease drilling immediately and close the bore-hole.

4.0 TRAINING INFORMATION ON HEALTH AND SAFETY PROCEDURES

Drilling operations will expose the field team to a noise hazard and based on previous experience with similar operations, hearing protection will be required for the field team while operating rotary drilling equipment. Some tips to pay attention to when working around drilling rigs are given below:

- Always wear the proper personal protection as required by the safety plan.
- Always wear eye protection while working on site. Driving pins in drive chains, handling chemicals, breaking concrete, hammering or sledging, cutting wires, grinding, and or welding are all examples of work that is hazardous to your eyes.
- Don't set or drop a heavy object on your foot.
- Use the correct stance when lifting a heavy object.
- Watch out for slippery surfaces or objects to trip on.
- Always wear splash goggles when handling chemicals.
- Keep your clothing out of spinning rig equipment.
- Always get treatment for even the most minor scratch or abrasion.
- Watch out for swinging equipment. Most drilling equipment will break a rib if it hits you.

4.1 Health and Safety Training

Prior to starting the work, the Project Director will conduct a training session and ensure that each field team member understands his or her safety responsibilities.

All personnel assigned to drilling activities and water sampling efforts will be instructed regarding the potential health and safety hazards. Specifically, the following topics will be covered in the initial training session.

- o Potential routes of contact with toxic and or corrosive materials, excessive noise, or physical site hazards.
  - skin contact/absorbtion
  - eye contact
  - inhalation
  - ingestion
  - hearing exposure

- o Types, proper use, limitations and maintenance of applicable protective clothing and equipment.
  - safety helmet
  - eye protection
  - gloves
  - safety boots
  - tyvek coveralls
  - respirators

- o Respiratory protection using full-facepiece or half-facepiece air purifying respirator equipped with organic vapor cartridges and dust filters
  - forms of respirators: air purifying, air supplied, and self contained
  - selection of respiratory protection based on the hazard
  - NIOSH certification of all equipment to be used on site
  - medical/physical fitness to wear respiratory protection
  - use, limitations and maintenance of full and half-face respirators including qualitative fit testing, routine inspection, replacement of parts, cleaning, disinfection, decontamination, and storage requirments.

- o Proper decontamination procedures and adherence to work zone boundaries.

- o Reporting of accidents and availability of medical assistance.

4.2 Potential Routes of Exposure

Field team members can be exposed to a number of hazards on the site. Based on preliminary information, the following hazards and routes of exposure are known to be present.

- o fuels: respiratory hazard, ingestion hazard;

- excessive noise: auditory hazard; and

- drilling rigs: physical, eye, head, hand hazards.

4.3 Personal Protective Clothing and Equipment

Workers on site will use protective clothing and equipment to reduce or eliminate the risk of exposure to the hazards mentioned above. Workers will be trained in the proper use of such clothing and equipment before starting work.

Clothing

Protective coveralls will reduce the chances of contacting the waste material. The Tyvek coverall will provide protection against splashes, and dusts. The coveralls are not to be considered "impervious" and should be quickly removed upon obvious contamination.

Gloves

Gloves provided for this project will protect the hands from contacting the waste material. The Gauntlet style neoprene glove is used for handling grossly contaminated equipment and soil samples. The PVC disposable glove is used for routine site work, and should be considered "light duty" gloves. The PVC gloves will not provide a high level of protection against contaminated ground or surface samples, and may only be used when the chance of contact with these materials is unlikely. They should be removed and disposed of immedialtely upon contamination.

Eye Protection

Several levels of eye protection are available for this project. The full-facepiece respirator will provide eye protection against splashes and eye irritating gases and mists. Splash goggles will be used when steam cleaning equipment. Every team member will use proper safety glasses while on site.

Respiratory Protection

The respirators selected for this project will provide protection against anticipated levels of airborne gases, fumes, mists, and dusts. To ensure that the mask will perform as expected, the respirator must be inspected, fit tested, maintained, and stored properly, according to company policy and governmental regulations.

1. Inspection procedures:

   The face-piece (full or half) should be free of dust, dirt, rips, tears, and obvious contamination. The septa (three in

the half-facepiece, one in the full-facepiece) should be present and in good shape, watch for rips or dirt.

2. Fit Testing Procedures:

The first step in testing the fit of your respirator is called the negative pressure test. Block the inhalation valves (on the side of the mask) with the hands or plastic sheets and inhale slightly. You should feel the mask draw in on the face. Watch for air leakage around the face-piece indicating a poor facial fit. REMEMBER, NO FACIAL HAIR THAT INTERFERES WITH THE FIT OF THE MASK IS PERMITTED.

The next test (positive pressure test) is done by blocking the exhalation valve (at the bottom of the mask) with the palm of your hand. Exhale gently and notice for air leaking around the face-piece of the mask, indicating a poor fit. If air is leaking out of the mask, re-tighten the straps and perform the negative and positive pressure tests again.

The last test (qualitative testing) involves the use of an indicating odor that is passed around the mask fitted with ORGANIC VAPOR CARTRIDGES. The employee will be asked to position his or her head to the side, up and down to simulate normal working conditions. The detection of the odor indicates that the facial seal of the mask is inadequate. If the employee detects the smell, the trainer is allowed to tighten the straps and adjust the mask on the employee one time. If the odor test is unsuccessfull twice, another brand of mask should be fitted.

3. Maintenance of Respirators:

Respirators will be maintained to ensure that they work properly. Replace any missing part of the mask or strap, clean the mask with hot soapy water after each use, and do not let others wear your mask without disinfection first.

4. Storage of Respirators:

Respirators must be stored in a clean, safe, dry, environment (e.g. not near the working area or on the drilling rigs).

5. Use and limitations of Respirators:

Respirators selected for this project should be used properly and within the limits for which they were designed. These air-purifying respirators will be useful in concentrations well below the 1000 ppm filtration limit of the cartridges. Air monitoring will confirm that airborne contamintion does not exceed the use limitations of the respirator. These masks do

not provide oxygen and should not be used in confined spaces or oxygen deficient atmospheres.

4.4 Decontamination and Work Zone Procedures

Items that become contaminated must be cleaned up to prevent employee exposure and the spread of harmful materials. The field team will also be expected to establish work zones and comply with safety procedures and dress codes for each particular zone. Section 6 gives a description of the decontamintion procedures that will be used for this project. The following information will be given to the field team.

- o Work zone definition and marking;
- o Dress codes for each work zone;
- o Decontamination procedures for personnel, equipment, and heavy equipment.

Exclusion Zone

The exclusion zone is the area immediately surrounding the work area where the waste is being disturbed. For Monitor Well installation (hollow-stem and air rotary) the exclusion zone will comprise a circle extending 25 feet around the drilling rig. Proper personal protection consists of hand, foot, eye, respiratory, body, and head protection as listed in Section 3.2.

Contamination Reduction Zone (CRZ)

The contamination reduction zone is the area where decontamination will occur. The idea is to have personnel remove contaminants from themselve and their equipment inside the CRZ. This practice will avoid the spread of contamination into the support area.

Support Zone

The support zone is intended as an area that remains free of contamination and is used for staging activities, breaks, and eating. It is extremely important to keep this area clean and free of contamination. Never bring contaminated equipment, articles or yourself into this area without going through the decontamintion procedures first.

Decontamination Procedures

Personnel and equipment can become contaminated in a number of ways including:

- o Contacting vapors, gases, mists, or particulates in the air.

- Being splashed by materials while sampling or opening containers.

- Walking through puddles of liquids or on contaminated soil.

- Using contaminated instruments of equipment.

Protective clothing and respirators help prevent the wearer from becoming contaminated or inhaling contaminants. Good work practices help reduce contamination of protective clothing, instruments, and equipment.

The employee needs to be aware of donning and doffing procedures for protective clothing and equipment. These procedures are easy to follow:

- Gloves go on your hands first when putting protective clothing on; and

- Gloves come off your hands last, when undressing.

These procedures will be supplemented by performing decontamination on personnel, equipment and heavy equipment. Decontamination procedures consist of physically removing contaminants from the person or equipment with:

- Steam cleaning equipment;

- Diesel fuel and brushes;

- Acetone rinsing; and

- Detergent washing.

The drilling rig will be steam cleaned following contact with waste/soil material. The rig will then be spray washed and detergent washed prior to leaving the CRZ. Diesel fuel brushing is only required in the event that the auger flights become covered with waste that the steam cleaning will not remove.

Respirators should be washed with detergent/disinfection solution to remove any contamination. Respirators must be washed at the end of each day or more often if they become grossly contaminated.

<u>Emergency Procedures</u>

Emergency procedures are presented in this manual to address the possible site emergencies given below:

- Medical injuries;

- Fire and explosions;

- Excessive emissions from drilling activity;

Medical Injuries

Medical problems that can occur on site need to be handled competently and quickly. Each field team member should be aware of the instructions and information given below:

- Write down and post the telephone numbers of the local Base and community ambulances and medical facilites.

- Seek professional medical attention for personnel that are not breathing, bleeding severly, experiencing intense pain or are unconcious. Each member of the site team should know how to call for an ambulance (on Base and off Base).

- If you get anything in your eyes (chemicals or dust), flood them with water for 15 minutes. Be sure to tell a supervisor. The Supervisor will make sure that the victim washes the eyes for the full 15 minutes.

- Do not remove objects that are impaled (stuck) in the eye.

- Always seek medical attention for eye injuries.

- Stop bleeding with direct pressure. Place a bandage over the wound and press down with your hand. Use a tourniquet only in extreme cases when you are not able to stop severe bleeding.

- If you contact the waste, wash the affected area with soap and water as soon as possible. If large amounts of waste come in contact with the body, you will be required to take a full body shower with soap immediately.

Fire and Explosion Response Procedures

Fires on site can be caused by the drilling rig activity and welding activity. The drilling rig will have a fire extinguisher on hand at all times. The procedure for using a fire extinguisher is to pull the safety pin, point the extinguisher at the base of the flames and discharge the extinguisher by sweeping the flames from a distance of six feet. Move in closer as the flames are being put out.

- Never use water on an electrical fire or a solvent fire. All extinguishers should be dry chemical and labeled "Class A, B, C".

- Never weld in dry grass and always keep an extinguisher nearby.

- o Keep decontamination solvents well away from the steam cleaner.

Excessive Emissions Procedures

If the detector tube readings indicate that the drilling activity is producing excessive emmisions (any emission approaching the TLV), the following action needs to be taken:

- o Cease drilling and contain cuttings.
- o If emissions are not controlled, remove auger flights and close the borehole. Continuous air monitoring will be conducted during this type of emergency.
- o Be prepared to evacuate to an upwind site.

5.0 DECONTAMINATION PROCEDURES

To minimize the transfer of hazardous substances from the site, contamination control procedures are needed. Contaminatnts must be removed from people and equipment prior to relocation from a work zone.

5.1 Work Zones

The field team will prevent waste material from moving from the drilling site. The team will prevent migration of site contaminants by using work zones to control the spread of contamination. Decontamination procedures will also help reduce the chances of spreading contaminants.

Exclusion Zone

A 25 foot circle around the drilling site will be defined before drilling starts. The circle will constitute the "Exclusion Zone". This zone may contain potentially hazardous airborne and physical hazards to the workers. Full personal protection will be required in this area.

Contamination Reduction Zone

A corridor leading from the exclusion zone will be defined. This corridor should lead from the drilling rig to the break area. All decontamination activities will occur in this area. A waste container should be placed at the end of the corridor so contaminated disposable equipment can be dropped off.

Support Zone

A support zone must be defined for each well installation location. The zone should be at least 50 feet from the drilling rig and should be clean and free of contamination (surface and airborne). Air monitoring and visual

inspection of the support zone location will confirm that the area is relatively clean.

5.2 Personal Hygiene Requirements

Some general rules to obey when in the support zone are as follows:

- o You must wash your hands and forearms with soap and water before eating, drinking, smoking, anything.

- o You must wash your hands before using the toilet.

Remove personal protective equipment in the order given below while in the decontamination corridor.

- o first, remove any outer gloves or boot covers and drop them in the container provided

- o remove the tyvek coverall, save this coverall unless it is contaminated

- o remove your respirator

- o last, remove your inside gloves

Reverse the order of the doffing procedure when you are ready to re-enter the exclusion zone.